

A Review of
New Zealand's
School
Curriculum

An International Perspective

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for the Education Forum

EDUCATION FORUM

October 2002

First published in 2002 by the Education Forum,
PO Box 10-539, The Terrace, Wellington

ISBN 0-9582133-4-8

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Production by *Daphne Brasell Associates Ltd, Wellington*

Printed and bound by *Astra Print Ltd, Wellington*

CONTENTS

Acronyms	iv
Author and Acknowledgments	v
Executive Summary	vii
Chapter 1 Background	1
Chapter 2 The New Zealand Curriculum – what is it?	5
Chapter 3 The New Zealand curriculum – historical and international contexts	9
Chapter 4 The New Zealand curriculum – a critical evaluation	17
Chapter 5 Recent developments in some Asian education systems	43
Chapter 6 Conclusion	47
Appendices	
A The methodology used to ‘benchmark’ the Victorian Curriculum and Standards Framework	49
B Programme for International Student Assessment	52
C Detailed mathematics citations	55
D Education Forum	62
E Members of the Education Forum	63
Bibliography	64

ACRONYMS

AATE	Australian Association for the Teachers of English
ACER	Australian Council for Educational Research
ACSA	Australian Curriculum Studies Association
AFT	American Federation of Teachers
APAPDC	Australian Principals Association's Professional Development Council
APEC	Asia Pacific Economic Cooperation
CERC	Comparative Education Research Centre
CSF	Curriculum and Standards Framework (1999, Victoria)
CSF II	Curriculum and Standards Framework (2000, Victoria)
ERO	Education Review Office
KICE	Korean Institute of Curriculum and Evaluation
IARTV	Independent Association of Registered Teachers of Victoria
MoE	Ministry of Education
NBEET	National Board of Employment, Education and Training
NCEA	National Certificate of Educational Achievement
NCTE	National Council of Teachers of English
OBE	Outcomes-based education
OECD	Organisation for Economic Cooperation and Development
OFSTED	Office for Standards in Education (London)
PISA	Programme for International Student Assessment (OECD)
SOSE	Study of Society and the Environment (Victoria)
TIMSS	Third International Mathematics and Science Study (1995)
TIMSS-Repeat	Third International Mathematics and Science Study (1999)
VBOS	Victorian Board of Studies

AUTHOR AND ACKNOWLEDGMENTS

Dr Kevin Donnelly BArt, DipEd, MEd, PhD (Education) is executive director of a Melbourne-based consultancy group, Education Strategies. During his 12 years as a secondary school teacher in both government and non-government schools in Australia, Dr Donnelly taught English and humanities and was a subject coordinator. He has also lectured and tutored in education at La Trobe University, Melbourne. He has been a Year 12 examiner in both English and English Literature and a member of a number of state and national curriculum committees. Dr Donnelly's doctoral thesis deals with developments in school curriculum over the last 25 years both in Australia and overseas. Dr Donnelly has published over 180 articles in the daily media and professional journals, writes regularly for the Melbourne daily newspaper, *Herald Sun*, and often speaks on radio, both state and national.

Since establishing Education Strategies in 1994, Dr Donnelly:

- completed, in 2000, an analysis and critique of the National Certificate of Educational Achievement on behalf of the Education Forum in New Zealand;
- undertook, during 1998–1999, a 'benchmarking' exercise comparing the Victorian Curriculum and Standards Framework in mathematics, science and English against a range of overseas curriculum frameworks and syllabi;
- served, between 1997 and 2002, as a consultant to the federally funded Discovering Democracy Civics and Citizenship Education programme;
- acted, from 1995 to 1997, as director of a multimedia CD ROM curriculum initiative, the Understanding Australia project, for the Victorian Directorate of School Education, and in 1997 was appointed as an executive member to the Board of the Victorian Board of Studies;
- provided, between 1994 to 1999, policy advice to the Office of the Victorian Minister for Education and the Office of the Director within the Victorian Directorate of School Education. Areas covered included the senior school curriculum, the implementation of the national curriculum and Victoria's Curriculum and Standards Framework, and benchmarking against the South East Asian 'tiger' economies; and
- undertook, in 1996, a strategic review of the Queensland Education Department for Mr Bob Quinn, the minister for education, focusing on management, organisation and curriculum at the senior policy level.

Dr Donnelly is grateful to Brian Crittenden, Paul Henderson, Michael Irwin, Frances Kelly and Alan Smithers for many valuable comments on drafts of this report. However, the views expressed in this report should not be ascribed to any of those whose assistance is acknowledged above.

Dr Donnelly is also grateful to Dr Max Stephens for his analysis of the New Zealand mathematics curriculum in section 4.2.6 of this review. Dr Stephens is currently a senior associate at the Department of Science and Mathematics Education at the University of Melbourne, and an adjunct professor in education at the Royal Melbourne Institute of Technology. Until 1995, Dr Stephens was manager of the Mathematics Key Learning Area at the Victorian Board of Studies. He is also the current president of the Mathematical Association of Victoria and former president of the Australian Association of Mathematics Teachers. He has published extensively in curriculum and mathematics education, and is a frequent professional visitor to countries in Asia, especially Japan.

EXECUTIVE SUMMARY

This report identifies a number of defining characteristics of New Zealand's curriculum framework and its associated national curriculum statements and critically evaluates them in the light of international developments in school curriculum. Drawing on the work undertaken by the author in 'benchmarking' the Victorian Curriculum and Standards Framework (Donnelly, 1999) and in offering a comparative analysis of the National Certificate of Educational Achievement (NCEA) (Donnelly, 2000), the report compares the New Zealand curriculum against international 'best practice' in school curriculum.

The report is timely given the decision by the New Zealand Ministry of Education (MoE) to undertake a stocktake of the New Zealand curriculum. According to a ministry document, an external element of this stocktake is "an international critique of the curriculum documents" (MoE, 2001a, para 42). Under the heading "International critique" (paras 43 to 47) the document also states:

... curriculum experts outside New Zealand will be invited to prepare a critique of the NZ Curriculum Framework (the document and the policy it represents) and the seven national curriculum statements ...

The main objectives of this exercise are:

- to address issues of philosophy, epistemology, pedagogy relating to the curriculum documents and the process used to develop them;
- to provide the Ministry with external perspectives on the documents referenced to current international curriculum practice and thinking;
- to identify curriculum policy issues which should be addressed in future curriculum developments.

That such a critique is needed is generally accepted given the impact of globalisation and the ever-increasing competitive nature of international economic and financial systems. To ensure success in the so-called 'knowledge-based' economies, countries across the Organisation for Economic Cooperation and Development (OECD) and Asia Pacific Economic Cooperation (APEC) areas have all acknowledged the fundamental importance of education. Central to this is the need to develop and sustain an effective and successful education system that is 'benchmarked' against international 'best practice'.

In *The New Zealand Curriculum Framework* (MoE, 1993, p 3) the statement is made that:

The New Zealand Curriculum seeks to raise the achievement levels of all students and to ensure that the quality of teaching and learning in New Zealand schools is of the highest international standard.

This review concludes that the New Zealand curriculum framework and associated national curriculum statements fail in this regard. In terms of curriculum theory and practice, the recently introduced New Zealand curriculum is sub-standard and flawed. While the intention has been to improve standards, there is no readily identifiable evidence that this has occurred, and the approach to curriculum development adopted in New Zealand in 1993 is now outdated. In particular, New Zealand's curriculum framework and national curriculum statements:

- adopt a flawed and sub-standard outcomes-based approach to curriculum that, while being prevalent during the late 1980s and early 1990s, has since been largely abandoned by equivalent education systems such as those in Australia and the United States;
- fail to recognise properly the strength and superiority of either a 'syllabus' or 'standards' approach to curriculum development utilised by successful education systems such as Singapore, the Netherlands, the Czech Republic and South Korea;
- uncritically adopt a process-based approach to curriculum that fails to recognise properly the central importance of educational content;
- unduly emphasise a student-centred view of learning to the detriment of what the American academic Jerome Bruner terms the 'structure of the discipline'; and
- exist in isolation without any substantial attempt, at the time of writing this report, either to validate or strengthen them by undertaking an international comparative analysis similar to that undertaken by the Ministry of Education in Victoria, Australia, when developing its second edition of the Curriculum and Standards Framework.

CHAPTER 1

BACKGROUND

The New Zealand Ministry of Education (MoE) is undertaking a stocktake of the New Zealand school curriculum.¹ Normally, given the time, expense and resources involved in carrying out a stocktake, one might expect that such a process would involve a thorough and rigorous examination, if not evaluation, of New Zealand's curriculum framework and associated national curriculum statements. Indeed, the purpose of the stocktake suggests that this is the case:

The purpose of this project is to take stock of what the curriculum reforms of the last ten years have meant and to build assurance of the curriculum as policy and in practice, as a means towards raising achievement for all students. It will also look at future needs and establish an agreed strategic direction for the ongoing development and renewal of the curriculum, now that a full set of documents has been published (MoE, 2001b).

The intention appears to be that the stocktake will be broad – encompassing both theoretical and practical issues ranging from how successful teachers and schools are in implementing the New Zealand curriculum to evaluating the philosophical and epistemological issues underpinning it. If, as noted in the above quotation, the purpose of the stocktake is to guarantee a curriculum that that will raise the “achievement of all students”, then one might also expect, if the current New Zealand curriculum is found wanting, that there would be a willingness to address and remedy any weaknesses found.

Unfortunately, this does not appear to be the case. The statement on the ‘Curriculum Stocktake’ on the ministry’s internet site under the heading ‘What is the Curriculum Stocktake Project?’ suggests that the intention is to keep things as they are and to accept as given, notwithstanding any evidence of weaknesses, the established qualities and attributes of the New Zealand curriculum framework and associated statements.² The passage reads:

Alongside the introduction of new curriculum timelines in 1997 came a promise that, following the publication of the full set of curriculum statements, *a time of consolidation and reflection would occur* [italics mine]. With the publication of the Arts curriculum in September 2000, we are now at that point. *The object therefore is not to rush into revision of the curriculum* [italics mine], but to take stock of the last decade’s developments and their

¹ See the ‘Curriculum Stocktake’ Internet site for an explanation of the nature and purpose of the ‘stocktake’ <http://www.tki.org.nz/r/stocktake/index_e.php>.

² <http://www.tki.org.nz/r/stocktake/index_e.php>.

implications for teaching and learning, and to consider what they indicate for future curriculum directions.

That those responsible for undertaking the stocktake might be somewhat equivocal as to its outcomes should not be surprising. After all, many of those involved in organising and managing the stocktake were involved in designing, implementing and publicly defending the new curriculum and associated statements.

The purpose of this review is to identify a number of defining characteristics of the curriculum framework and its associated statements and to evaluate them critically in the light of historical and theoretical developments in school education, both within New Zealand and overseas. A sample of curriculum statements, for English, Social Studies and mathematics, has been briefly surveyed. Thus, the paper will not attempt to evaluate how effectively the New Zealand curriculum is being implemented in classrooms.

Given the resources and time allotted to writing this paper, it has not been possible to employ the benchmarking methodology used for the Victorian Curriculum and Standards Framework, as outlined in appendix A, in evaluating the New Zealand curriculum framework. However, unlike the official stocktake, there will be a willingness to move beyond 'reflection', to identify the shortcomings of the new curriculum, and to identify international 'best practice' that might be useful if, and when, there is a serious commitment to strengthening New Zealand's school curriculum.

One final proviso should be noted. An alternative to defining a national curriculum as a way of specifying what should be taught and learnt in schools is through examination prescriptions – this applies particularly to senior secondary schools. New Zealand is introducing a new school exit qualification – the National Certificate of Educational Achievement (NCEA) at Years 11, 12 and 13 (Forms 5, 6 and 7). The NCEA is not being considered in this review because it has been addressed in another report, published in 2000 by the Education Forum, as well as in other Education Forum publications.³ The ways in which the curriculum and examinations requirements interact in various countries could be usefully explored, but this is beyond the scope of the present review.

Suffice it to say that the NCEA's Achievement Objectives against which students will be assessed are to be derived from the outcomes in the national curriculum statements at the appropriate levels. To the extent that the curriculum outcomes are poorly specified, there will be potential for serious consequences for the implementation of the NCEA in terms of the soundness of the teaching and learning that the NCEA promotes, the reliability, validity and usefulness of NCEA reports on individual students, and in terms of teacher workload and potential for over-assessment.

³ Donnelly (2000). For this and other critiques of the NCEA see <www.educationforum.org.nz>.

The industrial turmoil in New Zealand's secondary schools in 2002 reflects in part a rising level of concern with the NCEA and there seems to be some inclination to address its weaknesses. But it is important to realise that the NCEA cannot be 'fixed' without first addressing curriculum issues. To do otherwise is to risk making matters worse by addressing symptoms and not underlying causes.

CHAPTER 2

THE NEW ZEALAND CURRICULUM – WHAT IS IT?

The Ministry of Education's document entitled *New Zealand Curriculum Stocktake (2000–02)* defines the New Zealand curriculum, under the heading "An outcomes-based curriculum", as follows:

In common with a number of other education systems (England, Australian states, Canadian provinces, South Africa), the New Zealand curriculum has been specified in terms of expected or desirable learning outcomes for students, rather than as prescription or content for teachers to cover. Another common feature is that levels of the curriculum are achievement levels rather than year/class levels recognising that students progress at different rates (para 10).

In the context of this review, the ministry was asked "for a copy of any Ministry document which analyses the policy shift, that was effected during the 1990s, from contents-based syllabi to outcomes-based curriculum statements as a basis for school curriculum specification and which compares and evaluates the various alternative approaches to curriculum specification". The response was that "No documents pertaining to the shift from contents-based to outcomes-based curricula have been able to be found".⁴ There appears to be no ministry document that identifies the perceived problems with the previous curriculum, evaluates possible means of addressing them, and provides the reasons for adopting the changes made. Thus, we cannot review the analysis – if any ever existed – that led to the recent and fundamental changes to the school curriculum. All we can do is examine the characteristics of the new curriculum and the claims made in support of them.

The statement quoted above from paragraph 10 of the stocktake document identifies two defining characteristics of the New Zealand curriculum: first, that student learning is defined in terms of 'outcomes', in opposition to content; and, secondly, that such learning outcomes are linked to achievement levels covering a number of year levels, instead of specific year or class levels.

The same stocktake document also states that:

A fundamental principle underpinning the New Zealand curriculum is the premise that the individual student is at the centre of all teaching and learning. The curriculum recognises, as has been shown by extensive research both here and overseas, that teaching and learning are likely to be more effective if they engage with the prior views and knowledge of the learner (para 11).

⁴ Ministry of Education letter dated 9 March 2002.

Thus, in addition to adopting an outcomes-based and a developmental approach to learning, the New Zealand school curriculum also unashamedly extols a student-centred one.⁵ Notwithstanding the somewhat equivocal admission that “teaching and learning are more likely to be effective”, the writers are quite happy to state – without citing any supporting evidence – that the individual student must be “at the centre of all teaching and learning” (MoE, 1993, p 6).

The curriculum framework embodies a number of other characteristics that combine to give it its unique quality and flavour. These include:

- dividing the achievement objectives into eight levels;
- defining the curriculum in terms of seven essential learning areas and eight essential skills;
- defining learning objectives more broadly so as to enable teachers to develop more specific objectives suited to their individual schools; and
- advocating a constructivist approach to learning based on the assumption that, “Students need to be flexible and adaptable and to *learn how to learn* [italics mine] rather than how to absorb a particular knowledge base” (*New Zealand Curriculum Stocktake (2000–02)*, para 14).

Given the above characteristics, and based on a comparative analysis of school curriculum across a range of countries undertaken by the author,⁶ it is possible to position the New Zealand curriculum in terms of how other education systems around the world define the intended curriculum. As distinct from either a syllabus or standards approach, the New Zealand approach can be identified as outcomes based.

New Zealand’s outcomes-based approach has been noted by several commentators. For example, the following comment is made about New Zealand’s mathematics curriculum:

There is less emphasis on specific topic content to be taught and more on learning outcomes to be achieved by students (Robitaille, 1997, p 274).

New Zealand’s Education Review Office (ERO) makes a similar observation after analysing the intended curriculum of Singapore, Korea, the Netherlands, Ireland and New Zealand:

⁵ In this context, ‘developmental’ is a description of a curriculum based on outcome statements that apply across a range of year levels on the assumption that learning develops over a number of years and individual students progress at different rates. It contrasts with the syllabus-based curriculum in which students are expected to master set knowledge, understanding and skills at the end of specific year or grade levels before they progress further.

⁶ For a summary of the analysis see Donnelly (1999). The analysis was undertaken on behalf of the Victorian Department of Education and involved a detailed analysis of 18 curriculum documents in mathematics, science and English across 10 countries, including New Zealand.

The curriculum statements [of New Zealand] contain achievement objectives and some suggested learning experiences *but do not list the content to be covered* [italics mine] (Education Review Office, 2000, p 11).

Unlike the New Zealand curriculum, the intended curriculum of the other four systems surveyed by ERO, all of which achieve significantly better results in international tests such as the Third International Mathematics and Science Study (TIMSS) (1995) and TIMSS-Repeat (TIMSS-R) (1999), adopt a content-focused, syllabus-type, approach. The main differences in these approaches are outlined in Table 1.

Table 1: Differences in curriculum approach

Syllabus	Outcomes	Standards
focus on what students should be taught/expected to learn	focus on what students should achieve or be able to do	identify what students should know and be able to do
based on established disciplines/categories of knowledge	mixture of established disciplines and a multidisciplinary approach	based on established disciplines/categories of knowledge
relate to specific grades/year levels	address levels that incorporate a number of grades/year levels	focus generally on specific grades/year levels
expectation that essential knowledge, understanding and skills are mastered at key stages (high stakes tests and streaming)	developmental, constructivist approach to learning	expectation that essential knowledge, understanding and skills are mastered at key stages (some states expect students to repeat a year if standards not met)
greater emphasis on teacher-directed, whole class teaching	an individualistic, child-centred approach to teaching and learning	greater emphasis on teacher-directed, whole class teaching
common curriculum, or within distinct and separate curricular pathways, based on a core plus electives where a pathways approach is employed	common curriculum	core/elective curriculum
discrete areas of study and topics	particular topics (such as literature or geometry) often dispersed across strands	discrete topics
mandated number of hours	number of hours not stipulated	number of hours not stipulated

The above three categories are not mutually exclusive, and there are some curriculum documents, such as Victoria's Curriculum and Standards Framework II, that contain elements of all three. In addition, standards can be seen as a more rigorous way of defining outcomes. There are, however, significant differences between the approaches. Such differences are especially obvious when examining and comparing the outcomes approach exemplified by the New Zealand curriculum against other curriculum documents. Some of the more important differences include:

- whereas syllabus and standards approaches target learning to specific year levels, an outcomes approach specifies learning outcomes across a range of year levels;
- whereas syllabus and standards approaches recognise the central importance of the content associated with the established disciplines, an outcomes approach emphasises the process of learning to the detriment of identifying worthwhile content;
- whereas syllabus and standards approaches recognise the importance of teacher-directed lessons, an outcomes approach defines the teacher as a 'facilitator' and places greater emphasis on group work and individualised learning;
- whereas an outcomes approach minimises the place of norm-referenced, summative assessment, both standards and syllabus approaches incorporate 'high-stakes' testing and consequences for success/failure; and
- whereas a syllabus approach defines essential knowledge, understanding and skills associated with particular subjects at the beginning of the year or term, outcomes and standards approaches detail what students should know or be able to do by the end of the year or term.

The significance of the fact that the New Zealand curriculum embodies an outcomes-based approach will be discussed in section 4.2.3 of this review. In brief, those education systems that achieve the best results in international tests such as the TIMSS (1995) and the TIMSS-R (1999), for example Singapore, South Korea, Hong Kong, Taiwan, the Netherlands and the Czech Republic, adopt a syllabus approach. Those countries, such as Australia, New Zealand and the United States, which, by comparison, perform less well, embrace an outcomes approach.⁷

Given the strong results attained by New Zealand students in the Organisation for Economic Cooperation and Development's (OECD's) Programme for International Student Assessment (PISA) 2000, an argument has been put forward that New Zealand students are performing very well compared with overseas students. Several cautions against such a conclusion are offered in appendix B.

⁷ As discussed later in this review, while education systems in the United States and Australia adopted an outcomes approach to curriculum design in the 1980s and 1990s, more recently several states within the United States and the Australian state of Victoria have changed to a standards approach.

THE NEW ZEALAND CURRICULUM – HISTORICAL AND INTERNATIONAL CONTEXTS

3.1 Introduction

The 1980s and 1990s have ushered in a new phase with the emphasis more on student outcomes and curriculum frameworks ... Recently, curriculum documents have concentrated more on outputs rather than teacher inputs (Marsh, 1994, p 15).

As the Ministry of Education noted in its *New Zealand Curriculum Stocktake (2000–02)*, New Zealand's present curriculum has common features to those in England, Australia, Canada and South Africa. At the time of its development during the early-to-mid-1990s, education systems across the English-speaking world were embarking on a good deal of curriculum development and renewal. After a period of school-based curriculum development, in particular in England and Australia, departments of education began to impose what appeared to be a more structured and systematic approach to defining the intended curriculum. In England, this took the form of the National Curriculum, and in Australia the change was evidenced by the development of the national curriculum statements and profiles. The New Zealand curriculum was, in most respects, built on this outcomes approach and, thus, lends itself to the same types of criticisms that have been directed at the Australian, English and other similar, outcomes-based curriculum documents.⁸

It should be noted that the problems with an outcomes-based approach to curriculum design do not arise simply from the inclusion in curricular documents of expected learning outcomes. The significant feature of the outcomes-based approach to which this review refers, and one leading to the problems discussed later, is that it divorces desirable learning outcomes from the content and methods that make up any systematic field of knowledge. The problems lie in this separation.

3.2 The Australian context

It should be noted that when the Australian national curriculum was being developed, and immediately before it was tabled for discussion at a meeting of state and federal ministers of education in Perth (July 1993), it was roundly attacked for representing a 'dumbed down' and flawed approach to curriculum development.⁹

⁸ An historical overview of curriculum development in New Zealand can be found at <http://www.tki.org.nz/r/stocktake/to_date/history_e.php>.

⁹ See Donnelly (1993) for an outline of the type of criticisms directed at Australia's national curriculum statements and profiles.

A number of academics and professional bodies criticised the Australian mathematics statements and profiles as lacking the required academic standards and rigour. Similarly outlined by Marsh, one time director of the Secondary Education Authority in Western Australia:

In a very well orchestrated campaign led by academics from the Australian Mathematical Science Council, over 200 Mathematics academics signed a petition which strongly criticised the draft Mathematics profile. The authors of the petition contended that the Mathematics National Profile was “substantially flawed and gave an entirely unbalanced view of the skills needed by a student to cope with training in any subject requiring a knowledge of Mathematics” (Marsh, 1994, p 155).

The science documents were also criticised by the Australian Academy of Science, the Australian Institute of Physics and the Royal Australian Chemical Institute for failing to deal with essential knowledge, understanding and skills and for failing to extend properly and challenge the academically able.¹⁰ Indeed, such was the intensity of the criticisms that the Australian education ministers did not accept the statements and profiles and, instead, returned them to the state and territory departments of education for further development.¹¹

A more recent critique of outcomes-based education, exemplified by Australia’s national statements and profiles and the equivalent documents in the various states and territories, can be found in a paper delivered at the 2002 Curriculum Corporation Conference by Bruce Wilson, the head of Australia’s Curriculum Corporation.¹² Despite Wilson’s involvement in developing Australia’s national statements and profiles and his subsequent defence of outcomes-based education, he now argues that outcomes-based education has failed and that it is time to adopt what he terms “standards for student learning”. Wilson’s critique of outcomes-based education includes the following statements:

- Learning outcomes as now understood in Australia do not do what they are supposed to do: define expected student learning.
- For this and other reasons, we fail to specify knowledge and skills. As a result, our documents are often of little assistance to teachers in developing classroom programs.
- The eight Key Learning Areas (KLAs) are an obstruction to improvement.

¹⁰ See “A Response to the National Science Profile”, *Australian and New Zealand Physicist*, Volume 30, Number 4, April 1993.

¹¹ See Marsh (1994), Chapter 7, for a summary of the controversy surrounding the Australian national curriculum.

¹² See Wilson (2002). That this critique was developed by Bruce Wilson is significant because Wilson defended outcomes-based education when it was first introduced into Australia at the time of the national curriculum statements and profiles (Wilson, 1993, 1994).

- Our approach to cross-curricular essential skills complicates our curriculum policy documents.
- The coming together of these factors has caused us to miss the point about deep understanding, which has now been comprehensively illuminated by research (Wilson, 2002, p 1).

In addition to the above criticisms, Wilson admits that the national statements and profiles have always been inherently flawed; he states that, when first developed, they represented an “unsatisfactory political and intellectual compromise” (p 7). That the chief executive officer of Australia’s leading curriculum body now argues that an outcomes-based model of curriculum development is flawed and obsolete should, given the similarities between Australian and New Zealand curriculum documents, be cause for concern amongst those responsible for the New Zealand stocktake.

It should also be noted that the various Australian national statements and profiles (that represent the models of curriculum development on which the New Zealand curriculum statements appear to have been based) were never intended to be syllabuses. As stated by Marsh (1994):

It is important to note that curriculum frameworks are not syllabuses which teachers will translate directly into their teaching ... (p 15).

... At the April 1993 CURASS [the Australian Education Council’s Curriculum and Assessment Committee] meeting the chairperson reaffirmed that state systems would provide the syllabuses which are the missing link between national statements and profiles – without syllabuses to support the national statements and profiles, they can’t ‘fly’ (p 154).

Notwithstanding the vast amounts of time, money and resources spent developing the statements and profiles, the fact was that teachers and schools would still be confronted by the challenge of translating the curriculum documents into actual syllabuses or course guidelines that would then be implemented at the school level. That such a process was, and still is, unnecessarily time consuming and onerous is acknowledged by the Education Review Office (2000, p 3):

Only in New Zealand have teachers been expected to develop teaching programmes directly from national curriculum objectives, which is a difficult and time-consuming task.

One of the benefits of a syllabus approach to curriculum development, compared with an outcomes approach, is that teachers are given clear, succinct and unambiguous guides as to what should happen in the classroom in particular subjects. The situation in countries like Japan, South Korea and Singapore, which adopt a syllabus approach, is that teachers are then freed to concentrate scarce time and resources on professional development and improving teacher effectiveness.

3.3 The English context

Prior to 1988 there was no national curriculum in England and what secondary schools taught was determined by examination syllabuses and prescriptions. The first edition of the National Curriculum for England was widely criticised. In particular, teachers attacked the unwieldy and cumbersome nature of the English curriculum and, especially in relation to primary schools, argued that it was impossible to implement the curriculum in a balanced and effective way. Such was the force of these criticisms that the government of the day agreed to rationalise the national curriculum, and a scaled down version was subsequently produced. It should also be noted that a number of progressive teaching and learning approaches adopted in the national curriculum, in particular in mathematics, have subsequently been criticised in official reports. The report *Numeracy Matters: The Preliminary Report of the Numeracy Taskforce* (Department for Education and Employment, 1998) recommended a number of changes to what constituted the prevailing orthodoxy associated with an outcomes-based approach. In particular, the report recommended:

- a greater emphasis during the early years on oral and mental arithmetic;
- reducing the range of topics covered in the early years, with a renewed focus on foundation learning;
- more classroom time to be given to whole class teaching; and
- reducing the use of calculators during the early years of schooling.

More recently, Her Majesty's chief inspector of schools, Chris Woodhead, resigned from his position in protest against what he termed the "new educational orthodoxies" and roundly criticised the outcomes-based approach to education so prevalent in countries like England, Australia and New Zealand:

Why is it so many apparently intelligent people are so willing to welcome the new educational orthodoxies ... The majority view at most conferences I attend is: that skills matter more than knowledge, that knowledge amounts to little more than a collection of tedious, irrelevant and probably out-of-date facts, and that we need therefore to undertake a fundamental review of the traditional academic, subject-based curriculum. It is, further, that we must focus on learning not teaching, teach children (whatever this might mean) to learn for themselves, and abandon any belief in the importance of didactic teaching that might linger in our unreconstructed professional heart.

... This is a new vision and it is dangerous. It is dangerous because it threatens everything that is valuable in education ... (Woodhead, 2000, p 36).

3.4 The United States context

At the same time that New Zealand and Australia adopted an outcomes-based approach to curriculum design, educationalists in the United States began to condemn what was the equivalent approach in America and known as 'outcomes-based education' (OBE) or subject area standards.¹³ When the President of the American Federation of Teachers (AFT), the late Albert Shanker argued:

OBE reforms have the rhetoric of higher standards down pat: They talk economy. But whereas the education standards in other industrialized countries call for things like solving algebraically and by graph simultaneous linear equations or analysing the causes of the Cold War, OBE standards are vague and fluffy (Shanker, 1993, p 1).

Such was the force of the critique against OBE that Marzano and Kendall (1997), after outlining the origins and development of OBE in the United States, concluded:

In summary, the once bright promise of subject area standards, born from a desire to improve the rigor and effectiveness of American education, has faded under a wide array of criticisms, and the movement itself has bogged down under its own weight (Marzano and Kendall, 1997, p 5).

Education systems across the overwhelming majority of the American states have gradually replaced OBE with a standards approach to defining curriculum. As shown in the table outlining the three different approaches to curriculum (Table 1, in section 2), there are a number of significant differences between what is seen as the preferred option in the United States and what is currently the case in New Zealand. Effective standards,¹⁴ when compared with outcomes:

- are related to specific year levels instead of covering a range of years;
- acknowledge the central importance of the academic disciplines;
- are 'benchmarked' against the world's best equivalent documents;
- incorporate 'high-stakes' testing and remove social progression; and
- are specific, easily understood and measurable.

The American Federation of Teachers, a strong critic of OBE, has established criteria for judging curricula. In brief, its *Criteria for High-Quality Standards* argues that:

¹³ Outcomes-based education (OBE) or what were sometimes referred to as subject area standards should not be confused with the more recent standards movement in the United States. Standards are considered an improvement on OBE in that they are more academically rigorous, specific and measurable.

¹⁴ For criteria used to assess standards refer to American Federation of Teachers (1993) and Fordham Institute (2001).

- 1 Standards must focus on academics (*sic*)
- 2 Standards must be grounded in the core disciplines
- 3 Standards must be specific enough to assure the development of a common core curriculum
- 4 Standards must be manageable given the constraints of time
- 5 Standards must be rigorous and world class
- 6 Standards must include 'performance standards'
- 7 Standards must define multiple levels of performance for students to strive for
- 8 Standards must combine knowledge and skills, not pursue one at the expense of the other
- 9 Standards must not dictate how the material will be taught
- 10 Standards must be written clearly enough for all stakeholders to understand.¹⁵

That a standards-based approach is significantly different to an outcomes approach can best be seen by comparing the type of descriptors employed in the respective curriculum documents associated with the two approaches to defining the intended curriculum (see sections 4.2.4–4.2.6 of this review for a number of examples). Descriptors employed in outcomes documents are usually broad, generic and difficult to define or measure; this is unlike standards descriptors, which are specific, easily understood, measurable and based on subject disciplines.

3.5 The South African context

South Africa is another country that has introduced an outcomes-based approach to curriculum development. Of interest is that, as happened in the United States following the critique of OBE, there is also growing opposition to what has become the new orthodoxy in education. A South African secondary school principal, Dr Malcolm Venter (2000), in a paper presented at the Australian Principals Association's Professional Development Council (APAPDC) Conference 2000, criticised OBE for:

- weakening the idea of striving for success by eliminating the concept of failure;
- unduly emphasising criterion-referenced assessment to the detriment of norm-referenced assessment;
- unfairly increasing the workload on teachers by imposing an individual-based, diagnostic assessment regime;

¹⁵ The American Federation of Teachers criteria can be found at <<http://www.aft.org/research/reports/charter/csweb/c.htm>>.

- reducing the emphasis on subject knowledge in preference to skills and process; and
- being couched in education jargon that 'disempowers' and alienates classroom teachers.

3.6 Reactions in New Zealand

Historically, New Zealand's curriculum had been expressed as syllabus statements, as they had been in Australia and England. With the release of the *Draft National Curriculum Statement* in 1988 and *The New Zealand Curriculum Framework* in 1993 the way in which the curriculum was defined and enacted underwent a radical change. Following the current curriculum developments overseas, the New Zealand curriculum adopted an outcomes-based approach characterised by the type of attributes listed in section 2 above.

Just as outcomes-based education was criticised in Australia and the United States, so also were criticisms directed at *The New Zealand Curriculum Framework* and its associated national curriculum statements. As acknowledged in the report-in-progress entitled, *Literature Review – Published Critiques and Commentary on the New Zealand Curriculum*,¹⁶ such criticisms emanated from a range of sources including the Education Forum, university education academics and the Education Review Office. (The Education Forum has made submissions or commissioned reports on all the main new curriculum statements, and these and other critiques are included in the Bibliography.)

¹⁶ The report-in-progress can be found on the Curriculum Stocktake internet site <http://www.tki.org.nz/r/stocktake/postings/litreview_e.php>.

THE NEW ZEALAND CURRICULUM – A CRITICAL EVALUATION

4.1 Introduction

It is notable that the *New Zealand Curriculum Stocktake (2000–02)* document acknowledges that a number of criticisms had been raised about the new curriculum framework and associated statements. In the words of the document, under the heading “Perceived problems of philosophy, purpose and epistemology” (para 23), the following comments are made:¹⁷

... [the] first part of the stocktake involved a literature search of New Zealand and international critiques of the curriculum framework and the individual curriculum document.¹⁸ Key issues which have been identified as common concerns are:

- the student-centred approach to teaching and learning in the curriculum – this includes the particular assertion that a “constructivist” approach is advocated and that this is, at best, misguided;
- the claim that the curriculum has become overly instrumental, is politically motivated, ‘politically correct’, and a form of social engineering – this includes claims of post-modernism and moral relativity from one side, and of a New Right, labour-market dominant infringement on the individual’s subjectivity from the other;
- the claim that the Ministry has never provided a satisfactory rationale for the eight level structure of the curriculum;
- questions about the goals and purpose(s) of schooling and whether or not these are agreed amongst the various stakeholders;
- a view that the curriculum should comprise subjects and not broad learning areas, eg history, geography and economics rather than social studies (although this may be more a concern in relation to the lower secondary curriculum);

¹⁷ Given the force and comprehensive nature of the criticisms listed one wonders how those responsible for the curriculum stocktake will respond; will the criticisms be acted upon or simply filed away and ignored?

¹⁸ An early draft of the literature search can be found at <http://www.tki.org.nz/r/stocktake/postings/litreview_e.php#2>.

- criticism that balance in the curriculum has not been defined in terms of time allocations for the various learning areas at different levels;
- the view that the curricula struggle to find a balance between a general education for all, and enough specification to prepare students for tertiary study and future employment in any of the areas;
- a preference for streamed classes or students being required to master certain knowledge and skills before moving on, as opposed to social promotion and mixed-ability classes with students working at different curriculum levels;
- a view that the curriculum statements are overly ambitious in relation to the capabilities of the majority of teachers and that insufficient guidance is provided in the statements on how schools should develop and teach their programmes; and
- a concern that skills are over-emphasised instead of knowledge, and a view that each curriculum statement should prescribe a body of knowledge which is to be taught.

To the above criticisms can be added, on the basis of the research carried out in writing this paper, the following observations:

- notwithstanding the original intention of the New Zealand curriculum framework “to raise the achievement levels of all students and to ensure that the quality of teaching and learning in New Zealand schools is of the highest international standard” (MoE, 1993, p 3), the results of the Third International Maths and Science Study in 1999 (TIMSS-R) show that New Zealand eighth-grade students underperform in comparison with students internationally. (In mathematics, approximately 20 countries outperformed New Zealand students; in science, approximately 18 countries outperformed New Zealand students.¹⁹);
- even though the New Zealand curricular documents have been gradually implemented since the mid-1990s for the express purpose of improving standards, there is little, if any, evidence of an improvement in student outcomes. As stated by a ministry official and member of the Stocktake Reference Group, “By and large, on all trend data, the curriculum itself has not raised achievement in the last nine years or so”;²⁰
- the New Zealand curriculum is based on a particular pedagogical and epistemological view of education that is now much discredited and considered obsolete;

¹⁹ A full report of the TIMSS-R study can be found at <<http://timss.bc.edu/>>.

²⁰ A transcript of the meeting from which this quotation is taken can be found at <http://www.tki.org.nz/r/stocktake/ref/meeting32_e.php>.

- compared with successful Asian education systems, which adopt either a syllabus or a standards approach, the New Zealand curriculum adopts an inferior, outcomes-based approach; and
- while the outcomes-based approach was prevalent in many education systems during the early-to-mid-1990s, education systems, such as in the majority of states in America and Australia, have moved from an outcomes-based approach to a standards approach. Further, as discussed in more detail in section 5 of this review, while there is an interest in some of the high-achieving Asian countries in moving towards an allegedly more innovative and creative approach to assessment and testing, there is also recognition of the weaknesses evident in the outcomes-based approach developed in the West.

4.2 Criticisms expanded

4.2.1 *The question of process versus content*

Good standards will ensure that students develop the intellectual powers of observation, communication, reasoning, reflection, judgment, perspective, and synthesis that are often lumped under vague phrases like “higher-order” or “critical thinking.” But they must pursue these skills through the content of the subject areas. Skills that are cut free from content and context are meaningless and impossible to teach or assess (AFT, 1993).

One of the defining characteristics of an outcomes-based approach is its focus on ‘process’ as opposed to ‘content’. The belief is that students should be helped to develop and strengthen so-called generic skills such as critical thinking and research skills (often embodied in the phrase ‘learning how to learn’) in opposition to being introduced to significant content. Ignored are the points that effective learning requires a proper balance between ‘content’ and ‘process’ and that particular skills arise generally within the context of particular disciplines. As argued by Professor Brian Crittenden, when discussing the ‘process’ approach to education:

The critical defect of this approach is that methods of inquiry, evaluation, criticism and so on can be applied effectively only in the context of relevant content (key concepts, theories, values, achievements in such activities as literature and the arts, etc.). Learning how to learn *does* depend on learning a carefully selected knowledge base (Crittenden, 2002, p 5).

In part, the origins of a process approach can be traced back to the 1970s and 1980s when the more traditional academic curriculum was attacked by critics who advocated a number of theories ranging from a progressive, romantic view of education (for example, Neill, 1972) to the Marxist inspired, socially critical view of schooling (for example, Bowles and Gintis, 1976, and Young, 1971).

During the 1990s, in countries like Australia, more recent variants of the 'process' approach can be seen in the competency movement. Reports such as those by Finn (1991) and Carmichael (1992) argued, on the basis of economic efficiency and the belief that 'knowledge' was always changing, that potential workers needed to develop work-related competency skills in opposition to academic knowledge and understanding. However, as Crittenden (2002, p 1) notes, the assumption of constant change removing the basis for knowledge content in curricula is fallacious:

In any area of systematic knowledge there is a range of key concepts, basic theories and method. They are not immune to change, but are relatively long-term. They are the defining features of a discipline or area of systematic knowledge. In several areas (such as the physical sciences) content has changed fairly rapidly, although methods have tended to be more enduring – and, in all cases, there is at least a core of relatively stable knowledge. The acquisition of a discipline's skills of inquiry needs to be closely related to the learning of its key concepts, theories and other central content.

Like advocates of an outcomes-based approach, many of the critics of contents-based curricula (drawing, in part, on the beliefs of the French philosopher, Rousseau) also argued that learning should not begin by defining what constituted worthwhile knowledge, understanding and skills. Instead, students should follow their own inclination for learning and teachers should 'facilitate', instead of assuming that it was their role to teach. In an attempt to justify their progressive views on education, advocates often referred to the American academic Jerome Bruner and his apparent belief that the emphasis of teaching and learning should be on the 'process' of learning. Unfortunately, as noted by Professor Crittenden, such advocates either failed to read Bruner in any detail or simply misunderstood his arguments:

Bruner never assumed that educationally worthwhile learning by discovery or problem solving could occur outside the context of a continually deepened understanding of the fundamental knowledge content of the disciplines. In *The Process of Education* he stated the theory summarized in the slogan "teach the structure of the discipline" (Crittenden, 1987, p 7).

Not only were the advocates of a 'process' approach guilty of misunderstanding one of its chief disciples, the problem also arose that many of the original advocates for change, on seeing the results of the progressive, socially critical view of education, argued for a return to a greater emphasis on content as represented by the academic disciplines. The American educationalist Neil Postman, one of the 1970s advocates for radical change, in his later years adopted a more conservative view of education. He states, in opposition to focusing on 'process':

I am referring to the idea that to become educated means to become aware of the origins and growth of knowledge and knowledge systems; to be

familiar with the intellectual and creative processes by which the best that has been thought and said has been produced; to learn how to participate, even as a listener, in what Robert Maynard Hutchins once called the Great Conversation ... (Postman, 1993, p 188).

The chief executive officer of Australia's Curriculum Corporation, Bruce Wilson (see also section 3.2), also acknowledges that effective and successful teaching and learning must recognise the central importance of the subject disciplines. After referring to the research associated with an American publication, *How People Learn*,²¹ undertaken by the National Research Council of the United States, Wilson argues:

The report offers powerful confirmation of the key idea in this paper: that transferable, higher order learning, what I am calling deep understanding, is inseparable from a well-organized body of content knowledge which reflects a deep understanding of specific subject matter (Wilson, 2002, p 6).

Within the Australian context, Marxist educators like Bill Hannan (1988) and Doug White (1988/1999) argued that documents like the Victorian Curriculum and Standards Framework (CSF) and the Australian national curriculum statements and profiles – on which the New Zealand curriculum appears to have drawn – failed the educational needs of students, especially those most at risk because of social disadvantage. One argument was that students from working class backgrounds could only be truly advantaged if they mastered the type of curriculum identified with the social capital associated with members of society who were more privileged. It was also stated that the immediate and local environment of many students was often narrow and restricted; thus, to deny students the opportunity to learn more widely about experience not normally encountered was socially unjust and an example of educational apartheid. As stated by the Australian Teachers Federation:

Students' rights to acquire new knowledge and ways of thinking – and the obligation of the school to stimulate this 'leap into the unknown' – should not be obstructed by a fixation with learning process at the expense of content, or highly relativist policies that treat all learning as 'equally valid' or concentrate only on the immediate and the subjective to the exclusion of the abstract and the objective in learning (Australian Teachers Federation, 1988, p 8).

More recently, the American Federation of Teachers (1993) has also argued that education, to be worthwhile, must give up an outcomes-based process approach and adopt a commitment to important knowledge, understanding and skills represented by what the Americans call a standards approach. In part, this is because a standards

²¹ An electronic copy of *How People Learn* can be found at the National Research Council's internet site: <<http://www.nap.edu/openbook/0309065577/html/index.html>>.

approach recognises, in opposition to restricting learning to the world of the individual student, the critical importance of the academic disciplines:

The purpose of setting standards is to improve students' academic performance. This should be the central mission of all our educational arrangements. Forging agreement around the academic content of the curriculum and the expectations we have for our children is the essential first step. If we can agree on what all students deserve to learn, we can focus our energies and resources on giving all kids the opportunities they need to read and write better; reach greater heights in math and science; and learn more about history, geography, literature, and the arts. These are the things that will make a difference in students' lives, and they are what parents care most about.

But there are some who would rather have standards focus on social and behavioural issues than on academics. Across the country, we've watched debates and legislative battles unfold around proposed education standards or 'outcomes' that stray from or avoid academics. These efforts, frequently referred to as 'outcomes-based education' or 'OBE,' are being challenged and defeated ...

In its more extreme form, the progressive movement in education adopted a subjective and relativistic epistemological stance. In English teaching, for example, writers such as Bleich (1975) and Holland (1975) and professional organisations such as the Australian Association for the Teachers of English (AATE) argued that reading (both reading the word and reading the world) was a subjective affair and that it is impossible to ever suggest that some interpretations or understandings might be incorrect.

The impact of postmodernism and deconstruction has accentuated an emphasis on the so-called relative and subjective nature of experience and understanding. As stated by Terry Eagleton, when referring to the impact of deconstruction on English teaching:

It is a shift from seeing the poem or the novel as a closed entity, equipped with definite meanings which it is the critic's task to decipher, to seeing it as irreducibly plural, an endless play of signifiers which can never be finally nailed down to a single centre, essence or meaning (Eagleton, 1983, p 138).

Clearly, advocates of deconstruction argue against the referential quality of language and suggest, in a somewhat contradictory fashion, that it is impossible to establish a common agreement on the meaning of words or the significance of personal utterances. The argument is contradictory in the sense that if the views of deconstructionists are taken at their face value, it would be impossible for them to ever logically claim that they were being misunderstood. As noted by Crittenden, there is also the concern that a child-centred, subjective view of education, related to postmodernism, denies the objective and communal aspects of learning:

If taken literally, its subjectivist theory undermines the whole effort of educating as a communal practice. In fact, it would seem to follow logically from postmodernist principles that no person should try to educate another – unless ‘education’ is interpreted as simply helping another person to define his or her own beliefs, values, sense of self and so on (Crittenden, 2002, p 7).

4.2.2 The place of student-centred learning

The New Zealand curriculum places the individual student at the centre of the curriculum and the work of schools. Once again, similar to the ‘process’ approach embodied in the New Zealand curriculum, this student-centred approach can be traced back to the curriculum upheavals of the 1970s and 1980s. At that time, the advocates of a student-centred view of education believed that it was largely inconsequential as to what was taught; what was more important was to value the world and the self-esteem of the student. Once again, progressive teachers often made reference to Bruner’s ideas without ever reading his works carefully. If they had they would have realised that Bruner was a strong critic of the student-centred view of education.

A generation ago, the progressive movement urged that knowledge be related to the child’s experience and brought out of the realm of empty abstractions. A good idea was translated into banalities about the home, then the friendly postman and trashman, then the community, and so on (Bruner 1971, p 63).

Bruner, when properly understood, acknowledges clearly the central importance of the disciplines. Michael Oakshott (1962) likened education to a conversation between the generations in which students are introduced to, and become familiar with, certain unique ways of structuring and understanding experience. The objective reality represented by the wider world predates the existence of the student and cannot be restricted to the student’s often limited and fallible understanding. As argued by Gramsci (1971) and Bettelheim (1979), education requires discipline, hard work and a structured initiation into an established and evolving body of knowledge, understanding and skills.

It should be noted that, at the time progressive education became adopted by official curriculum documents and many educationalists during the 1970s and 1980s, one of the most cogent and articulate critiques was developed by what was termed the philosophy of education movement. Educationalists such as Hirst (1974), Peters (1973), White (1973) and Crittenden (1981), to name a few, mounted a defence of what they termed a liberal/humanist view of education and formulated a number of criticisms of the progressive approach.

In part, the argument was that to be educated, by definition, required being initiated into an established and evolving body of knowledge, understanding and skills. Learning

could not be restricted to the immediate and local world of the student, especially when that experience and understanding was narrow, biased and superficial. Indeed, instead of restricting education to the world of the student, as the New Zealand framework seeks to do, teachers are obliged to challenge, extend and enrich students' knowledge and understanding.

Ironically, advocates of outcomes-based education, while arguing publicly in defence of the world of the student, appear to agree that education can never simply be restricted to what students feel is correct or necessary. The move to teach students the benefits of tolerance and mutual respect represented by multiculturalism, the move to teach students that gender bias is offensive, and the move to teach students about the benefits of protecting the environment are all based on the belief that students' understanding and experience, when seen to be narrow and misdirected, must be questioned and challenged. It is simply not good enough for the New Zealand curriculum to base an education system on the belief "... that the individual student is at the centre of all teaching and learning".

Advocates of the philosophy of education movement also argue that one of the benefits of a liberal/humanist view of education is that it enables students to become culturally literate (in particular, see Crittenden, 1987, and Hirsch, 1988). The restriction of education to the world of the student, especially when that world is narrow and insular, denies students the right to enter, on some basis of equality, into the wider, more public conversation. Whether it be classical allusions in newspaper headlines to 'pandora's box' and 'achilles' heel', or whether it be politicians' speeches employing sayings such as 'he met his Waterloo', or concepts such as the 'Westminster system', if students have not been taught such things it is very rare for them to learn them intuitively or by accident.

Indeed, as argued by Marxists such as Gramsci (1971) and Freire (1974), a crucial aspect of education is to liberate and empower students, especially those who are socially disadvantaged for whatever reason, and thereby to enable them to take greater control both of their lives and the wider society in which they are forced to move. Thus, much of the criticism of the progressive education movement, represented by the outcomes-based approach embodied in the New Zealand curriculum, originates not only from so-called conservatives or traditionalists but also from those committed to a Marxist perspective on education and social change.

4.2.3 Syllabus, outcomes or standards

In 1999, the Victorian Ministry of Education undertook a review of its CSF in preparation for developing a second edition. An important aspect of this curriculum review was a 'benchmarking' exercise carried out by the author, with the assistance of the Victorian Board of Studies (VBOS). This exercise compared approaches to curriculum development in mathematics, science and English across a range of education systems, including Singapore, Japan, England, New Zealand, Australia, Canada and the United States. The aim of this comparative analysis was to identify successful education

systems, as measured by success in international tests such as TIMSS, and to identify the approaches to curriculum development these countries used. The analysis was limited to comparing the intended curriculum as evidenced by official curriculum documents. Experts from VBOS in mathematics, science and English examined some 18 curriculum documents over several months.

As discussed in section 2, the curriculum documents of these countries are very different in nature and can be divided into those that adopt a syllabus, an outcomes or a standards approach. The point was made that these categories are not mutually exclusive and that elements of more than one approach may be adopted within a particular curriculum. It should be noted that all the documents analysed in the Victorian benchmarking report seek to detail the intended curriculum. These documents are made up of a series of curriculum statements/descriptors that define what it is that students are expected to know and be able to do. In developing a methodology to compare curriculum documents the author drew on the work of the American Federation of Teachers, the Fordham Institute and the McRel Organization. These organisations address the question of which curriculum documents are the best by applying criteria that measure such things as: detail, clarity, academic rigour and measurability. Table 2 summarises the judgments made by subject experts from VBOS according to the criteria:

Table 2: Curriculum document measurement criteria

Mathematics	Victoria	Singapore	England	West Australia	California	Japan
Detailed	****	****	**	**	****	***
Unambiguous	***	***	***	**	****	***
Measurable	***	***	***	**	****	***
Conceptual content	***	****	***	***	***	****

Science	Victoria	Singapore	England	West Australia	California	Ontario
Detailed	***	***	***	**	****	****
Unambiguous	***	***	***	**	****	****
Measurable	***	***	***	**	***	***
Conceptual content	***	**	***	***	**	***

English	Victoria	US – new standards	England	New South Wales	California	New Zealand
Detailed	***	****	**	***	****	**
Unambiguous	***	****	***	***	****	**
Measurable	***	****	**	**	****	**
Conceptual content	***	****	***	**	***	**

**** Very strong evidence *** Strong evidence ** Some evidence *Limited evidence

In section 2 of this review, the statement was made that the New Zealand education authorities are quite happy to describe their curriculum as adopting an ‘outcomes’ approach rather than a ‘standards’ or ‘syllabus’ approach. The result of the comparative analysis undertaken for the Victorian Ministry of Education demonstrated that not only did those systems which achieved the best results in international tests such as TIMSS and TIMSS-R adopt a syllabus approach, but that New Zealand’s English document, when compared with five other English courses, was placed last in terms of the criteria.

4.2.4 A brief review of the New Zealand English curriculum

The VBOS investigation of English courses involved a detailed comparative analysis of six curriculum documents in the areas of:

- Speaking: presentation of a sustained point of view to an audience of peers.
- Reading: reading a classic or contemporary novel.
- Writing: writing in specific genres, for example, letters, reports, arguments, control of grammar (syntactic structures) and control of punctuation.

All of the documents were examined in terms of how, when and in what manner the above three areas were introduced and dealt with. Based on the criteria outlined earlier (detail, clarity and so on), judgments were made about the comparative strengths and weaknesses of the various curriculum documents.

In explaining why the New Zealand English statement was ranked so badly it is useful to look at a number of the actual curriculum statements/descriptors on which this judgment was made. One of the areas identified for comparison involved writing, in particular control of grammar (syntactic structures) and punctuation. The Californian document (Californian Academic Standards Commission, 1997), which was considered the strongest, presented a detailed, unambiguous and measurable statement:

GRADE 6. WRITTEN AND ORAL ENGLISH LANGUAGE CONVENTIONS

Students write and speak with a command of standard English conventions that are appropriate to each grade level.

Sentence Structure:

1.3. use simple, compound, and compound-complex sentences; use effective coordination and subordination of ideas to express complete thoughts

Grammar:

1.2 identify and use present perfect, past perfect, and future perfect tenses; subject-verb agreement with compound subjects; and indefinite pronouns

Punctuation:

1.6 use colons in business letters, semi-colons to connect independent clauses, and commas when linking two clauses with a conjunction in compound sentences

The equivalent level descriptor in the New Zealand document (MoE, 1994) is as follows:

WRITTEN LANGUAGE: ACHIEVEMENT OBJECTIVES READING AND WRITING PROCESSES

Levels 3 and 4. Exploring Language

In achieving the objectives of understanding and using written language, students should: identify, discuss, and use the conventions, structures and language features of different texts, and discuss how they relate to the topic.

The New Zealand descriptor begs the question of what particular “conventions, structures and language features” are to be dealt with and fails to give teachers and students a clear idea of what might be considered essential knowledge, understanding and skills.

A further example can be found in comparing the descriptors as they relate to reading classical and contemporary fiction. The United States New Standards (New Standards – 1997) document states at level 3:

PERFORMANCE DESCRIPTION

READING E1a The student reads at least **twenty-five books** or book equivalents each year. The quality and complexity of the materials to be read are illustrated in the sample reading list. The materials should include **traditional and contemporary literature** (both fiction and non-fiction) as well as magazines, newspapers, textbooks, and on-line materials. Such reading should represent a diverse collection of material from at least three different literary forms and from at least five different writers.

Examples of activities through which students might produce evidence of reading twenty-five books include:

Maintain an annotated list of works read.

READING E1b The student reads and comprehends at least **four books** (or book equivalents) about one issue or subject, or four books by a single writer, or four books in one genre, and produces evidence of reading that:

- makes and supports warranted and responsible assertions about the texts;
- supports assertions with elaborated and convincing evidence;
- draws the texts together to compare and contrast themes, characters, and ideas;
- makes perceptive and well developed connections;
- evaluates writing strategies and elements of the author’s craft.

Examples of activities through which students might produce evidence of reading comprehension include:

Produce a literary response paper.

The equivalent New Zealand statement for English states:

WRITTEN LANGUAGE: ACHIEVEMENT OBJECTIVES

READING FUNCTIONS

Students should:

- select and read independently, for enjoyment and information, different contemporary and historical texts, integrating reading processes with ease.

The conceptual content is elaborated somewhat in Reading and Writing Processes: Exploring Language, Thinking Critically and Processing Information. Under these headings the document provides very vague, general statements as to what students need to understand and be able to do. For example, under Exploring Language students should “identify, discuss, and use the conventions, structures, and language features of different texts, and discuss how they relate to the topic”.

Quite clearly the New Zealand descriptor, in comparison with the United States descriptor, is vague, general and capable of being interpreted in a number of ways.

It should also be noted that the shortcomings of the New Zealand English statement are not restricted to that subject. Many of the unique qualities of the New Zealand English statement, such as its student-centred, developmental and constructivist approach to teaching and learning, are common across all the New Zealand curriculum statements. The social studies curriculum is another example.

4.2.5 A brief review of New Zealand's social studies curriculum

As noted in section 3.4 above, the AFT is a strong critic of outcomes-based education and has established criteria for judging curricula. To illustrate the difference between strong and weak standards, it provided the following example in History:

Strong Standards	Weak Standards
Students should be able to describe how United States federalism was transformed during the Great Depression by the policies of the New Deal and how the transformation continues to affect United States society today (Grades 9–12)	Students should be able to understand, analyze and interpret historical events, conditions, trends, and issues to develop historical perspective (No further elaboration provided and no grade level indicated)

On reading the 'Achievement Objectives and Indicators' in the New Zealand social studies curriculum, it soon becomes apparent that, in terms of the AFT criteria, these outcomes are weak.

A comparison between the New Zealand social studies outcome statements and the approach adopted in the Victorian CSF II Study of Society and the Environment (SOSE) document offers a useful illustration of this weakness (CSF II is the most recent Victorian Ministry of Education Curriculum and Standards Framework). A number of 'Achievement Objectives and Indicators' related to 'Time, Continuity and Change' taken from the New Zealand document are given below:

Level 6

Students will demonstrate knowledge and understanding of:

- beliefs and ideas that have changed society and continue to change it;
 Students could demonstrate such knowledge and understanding when they:
 - give examples of beliefs and ideas that have changed society;
 - give examples of the way beliefs and ideas spread and become powerful forces for change or for continuity;
 - describe movements that have influenced individuals, cultures and societies in the past and that continue to influence them in the present and may do so in the future.

Level 7

Students will demonstrate knowledge and understanding of:

- how events have short-term and long-term causes and consequences;
 Students could demonstrate such knowledge and understandings when they:
 - identify short-term causes of events;
 - identify long-term causes of events;
 - explain the short-term and long-term consequences of particular events and their likely future significance.

As in the New Zealand English curriculum, the above outcome statements are vague, general and capable of being interpreted in a number of ways. 'Belief', 'ideas' and 'events' are not specified and there is little, if any, guidance to teachers as to what might be considered essential or important knowledge, understanding or skills that all students have the right to encounter. When there is a more detailed indication of what an

outcome statement might refer to, it is introduced by using the expression ‘could demonstrate’ – suggesting that the examples given are not prescriptive.

This approach is the opposite to that adopted in the most recent edition of the Victorian SOSE document (developed in conjunction with the CSF II). First, at the middle and senior level of schooling, the Victorian document specifies essential learning in what is termed ‘History’ and not ‘Time, Continuity and Change’. The Victorian document, under ‘Curriculum Focus’, specifies in some detail what students should learn about. At Level 6, in part:

Students investigate:

- significant events, including the Russian Revolution, World War 1, the 1930s Depression, World War II, Chinese Revolution, the Cold War, the fall of Communism
- the ideas and values of liberal democracy, socialism, capitalism, communism, democracy, nationalism, fascism, religious fundamentalism
- leaders or important people associated with the significant events of the twentieth century.

In learning about significant events, ideas and people, students will learn about:

- political institutions, such as monarchies, democracies, dictatorships
- cultural expressions which reflected the experiences and explored the meanings of events and people over the twentieth century
- advances in technology in the twentieth century, such as vaccinations, transport, arms, telecommunications, computers
- how the events and ideas of the twentieth century affected groups in society differently – in particular, social and/or ethnic groups, such as native Americans/European settlers; industrial working class/ruling elites; men/women; blacks/whites.

Not only does the Victorian SOSE document offer a detailed outline of what is to be taught, there is also a clear expectation that students will master specific ‘Learning Outcomes and Indicators’ that arise out of the prescribed content.

In relation to twentieth-century world history (as outlined above), students are expected to:

- 6.4 Analyse the impact of significant events and ideas in shaping world history in the twentieth century.
- identify significant events which shaped world history in the twentieth century, including World War 1, the Russian Revolution, the 1930s Depression, World War II, the Chinese Revolution and the Cold War and its aftermath

- discuss the ideas and people associated with the events
- evaluate the impact of the events and ideas on people, values and structures
- analyse the ways in which a significant event has been represented in cultural forms.

4.2.6 A brief review of New Zealand's mathematics curriculum²²

4.2.6.1 Introduction

The review by Professor Geoffrey Howson of the University of Southampton prepared for the Education Forum in 1994 (Howson, 1994) presented a careful and balanced overview of the strengths and weaknesses of published documents relating to mathematics in the New Zealand school curriculum. That review drew specifically on two documents: *The New Zealand Curriculum Framework* (MoE, 1993) in general, and more specifically on *Mathematics in the New Zealand Curriculum* (MoE, 1992).

Howson's review focused particularly on the adoption of the 'levels' model "concerning the organisation of secondary school classes, and on whether the needs of the less able and the non-academically inclined senior secondary school students will be adequately met" (Howson, 1994, Executive Summary). The issues raised at the time by Professor Howson are still relevant to any current appraisal of New Zealand's school mathematics curriculum.

In this review, the focus is somewhat different. Its purpose is to ask how well the 1992 mathematics document is able to provide teachers with clear advice on what content to teach, and how that content should be taught. This surely has to be one of the principal criteria by which a national curriculum document should be evaluated. If national curriculum documents are written primarily for schools, their importance for parents and the wider community cannot be downplayed. Parents need to have a clear sense of what their child is being taught, and how they can help with the teaching process.

The methodology adopted here is intended to complement the many cogent issues raised by Howson in his 1994 report. The purpose of this review is to place the 1992 New Zealand mathematics document alongside comparable syllabus documents provided by Singapore and Japan, and the Victorian Ministry of Education in its CSF II.

The current methodology focuses in particular on the topic of decimals, as presented in the four documents mentioned above, for teachers in the upper years of primary school and the first years of secondary school. By using decimals as a point of focus, we examine how curriculum advice is presented to teachers in two Asian countries whose high performance in international tests of mathematical achievement, such as TIMSS and

²² The following analysis of aspects of the New Zealand mathematics curriculum was undertaken by Dr Max Stephens (see Author and Acknowledgments).

the follow-up study TIMSS-R, is widely acknowledged. Of course, one cannot conclude that the high performance of students in Singapore and Japan is attributable solely to the syllabus documents provided in these two countries. Other factors such as teacher preparation, and the amount of time devoted to the teaching and learning of mathematics in school (and out of school), are surely relevant. Nevertheless, it will be argued that while it appears the same content is taught in Singapore, Japan, New Zealand and Victoria, there are clear differences in how that content is articulated in syllabus documents and interpreted and taught by teachers.

Nor should it be thought that teachers in Singapore and Japan have to deal with oppressive amounts of documentation. In fact, syllabus documents in these countries are relatively concise compared with related documents in Australia and New Zealand. For example, the entire national curriculum in mathematics for Japanese elementary, junior secondary and upper secondary schools is a mere 43-page document (Japan Society of Mathematical Education, 2000). However, the impact of these documents on the publishing of textbooks is quite profound. Publishers in Japan and Singapore have to seek approval from their respective ministries of education before any textbooks can be published. The point being made is that the relatively concise curriculum documents of these two countries are crafted to provide teachers with a clear understanding of:

- what should be taught at each Grade/Year level;
- the key approaches to be adopted to that content;
- what to include and what not to include at particular Grade/Year levels;
- how topics are to be sequenced across and within Grade/Year levels; and
- how they are to be related to other elements of the school mathematics curriculum.

The Victorian CSF II presents content by Levels that correspond generally to two-year stages of schooling. Level 1 presents content that is expected to be taught and achieved by most students by the end of Preparatory Year, the first year of school. Subsequent Levels 2–6 deal with two-year stages to the end of Year 10. Content is presented in the CSF II through its Curriculum Focus, Learning Outcomes and Indicators of what a student achieving at that level is typically able to do. In some respects, this approach is similar to that adopted by the New Zealand 1992 mathematics curriculum statement. Nevertheless, there are differences that are described later.

Singapore and Japan, on the other hand, both present content by Grade or Year level. This is not to imply that everyone will be at the same level of achievement, or that teachers should not move high-achieving students forward or return those who are behind to more basic content. One of the clear casualties of a 'levels' model is the difficulty in sequencing content within and across Grade/Year levels. This price results in teachers not having more detailed advice about what to teach and how. It is a price that Singapore and Japan are not prepared to pay. It is significant that the Victorian Curriculum and Assessment Authority, which was responsible for writing the CSF II,

has also provided teachers of mathematics with quite detailed Sample Programs in Mathematics. These Sample Programs present versions of a week-by-week programme for each Year level, and show how content should be developed throughout that Year level. Teaching topics are shown to correspond with particular outcomes presented in the CSF II. This is one way of trying to accommodate a standards framework with the need to provide teachers with very clear advice on what to teach.

A commendable feature of the New Zealand mathematics curriculum statement is the linkages it makes between achievement objectives, suggested learning experiences and sample assessment activities. In some cases, however, this linking does not work as intended. For example, the Level 3 achievement objective, “Order decimals up to three decimal places” is followed by an assessment example based around gymnastics scores, where all the scores are expressed as two-decimal place numbers.

4.2.6.2 *Introducing students to decimals*

Both Japan and Victoria expect that simple decimal ideas will be introduced to students during Grade/Year 4. Singapore introduces decimals to Primary 4 which appears to be equivalent to Grade/Year 5 in Australia and New Zealand. However, the introduction of decimals at this slightly later stage in Singapore needs to be placed alongside a much more rigorous introduction to fractions, including equivalent fractions and comparing and ordering fractions in Primary 2 and Primary 3. See appendix C for extracts of the relevant country curricula.

Japan

Grade 4

Children should understand the meaning of decimals and how to express them, should understand the meaning of adding and subtracting decimals, and should be able to perform these calculations.

- (a) To use decimals to express the size of remainders. To know how to express decimals and the one-tenths position.
- (b) To know that decimals are expressed in the same manner as integers, and to deepen understanding of the relative size of numbers.
- (c) To make methods of addition and subtraction of numbers down to the one-tenths position, and to be able to perform the calculations (p 13).

Victoria

Level 3 (for most students by the end of Year 4)

Use decimal notation to represent and compare simple decimal fractions including those resulting from calculator computations (MANUN 304).

This will be evident when the student is able to:

- read, say, write and compare and order numbers with two decimal places (eg 0.61, 12.24, 10.95);
- recognise that a decimal point in a number affects the magnitude of the number;
- use decimals to compare quantities in familiar contexts;
- interpret the results of calculator computations to the first decimal place (eg $7 \div 3$ is between 2.33 and 2.40);
- carry out calculations involving tenths and hundredths (MANUC 303);
- add and subtract numbers and quantities involving tenths and hundredths (e.g. $1.5 + 0.7 = 2.2$).

When New Zealand, in Level 3, and Singapore, in Primary 4, introduce the topic of decimals, they do so with similar specificity in their respective documents:

New Zealand

Level 3

Achievement objectives

Exploring number

- explain the meaning of the digits in decimal numbers with up to three decimal places;
- order decimals with up to three decimal places.

Suggested learning experiences

Exploring number

- developing meaning for decimal place values, using concrete models and a calculator ...;
- saying decimals, for example, 1.25 is one and twenty-five hundredths, or one and two tenths and five hundredths, ... 1.25 is read as 'one point two five', not 'one point twenty five';
- writing decimals in words and symbols;
- using calculators and number lines (rulers and other linear scales) to compare and order decimals;
- exploring number patterns which involve both whole numbers and decimals;
- investigating possible ways of renaming numbers using decimals, for example $1 = 0.4 + 0.6$, $1 = 0.2 + 0.2 + 0.2 + 0.2 + 0.2$, etc.

Singapore

Decimals

Number notation and place value

- Read and interpret decimals up to three decimal places.
(Include use of the number line to illustrate concept of decimals, Include identifying the values of digits in a decimal, Include sums such as the following):
 - (i) $0.125 = 1/10 + 2/100 + \square / 1000$
 - (ii) $0.125 = 125 / \square$
 - (iii) $21.203 = 21 + \square / 200$
 (Exclude $0.125 = 1/10 + 1/50 + \square / 200$)
- Compare and order decimals.

In other sections, however, the New Zealand document lacks specificity. Take, for example, the multiplication and division of decimals where the comparable statements of Japan and Singapore are much more carefully articulated in terms of how the topic is developed over two years. The Japanese document makes it very clear that multiplication and division of decimals must follow the same principles as multiplication and division of integers.

Japan

Grade 5

Numbers and calculations

- (3) Children should understand the meaning of multiplication and division, and should make use of them appropriately.

...

- (b) To understand the meaning of multiplication and division when the multipliers and divisors are decimals, **based on an understanding of multiplication and division for integers** [emphasis supplied].
- (c) To think about how to perform multiplication and division on decimals, and to be able to perform these calculations. To understand the size of the remainders. (Decimals down to one decimal place only.)
(Pages 15–16.)

Japan

Grade 6

Numbers and calculations

...

- (3) Children should understand the meaning of multiplying and dividing fractions, and to be able to do these calculations appropriately.

...

- (b) To understand the meaning of multiplication and division when the multipliers and divisors are fractions, **based on an understanding of calculations when the multipliers and divisors are integers and decimals** [emphasis supplied].
- (c) To think about multiplication and division with fractions, decimals, and to be able to do these calculations (p 18).

Singapore

Primary 4

Decimals: Multiplication and division

- Multiply and divide decimals up to 2 decimal places by a 1-digit whole number.

(Include division of a whole number by a whole number with decimal answers, Include rounding off answers to 2 decimal places, Include checking reasonableness of answers).

Singapore

Primary 5

Decimals: Multiplication and division

- Multiply decimals up to 2 decimal places by a 2-digit whole number.
(Include checking the reasonableness of answers by estimation.)
- Multiply and divide decimals up to 3 decimal places by tens, hundreds and thousands.

(Exclude cases where the first non-zero digit in the answer is at the 4th decimal place, such as $0.12 \div 1000 = 0.00012$.)

- Solve word problems involving decimals.

(Include rounding off answers to a specified degree of accuracy, Include checking reasonableness of answers.)

New Zealand

Level 4

Exploring computation and estimation

...

- write and solve problems involving decimal multiplication and division.

Suggested learning experiences

Exploring computation and estimation

...

- exploring the outcomes of multiplication and division using decimals;
- devising and using strategies for estimating the results of computations involving decimals;
- solving and writing problems involving the multiplication and division of decimals.

In some respects, the New Zealand document is strong, like its Asia counterparts, in drawing attention to the relationship between decimals and powers of ten. But even with this inclusion, the Japanese document places specific emphasis on having children understand the *relationship* between numbers that results from using powers of ten. The Singapore document is mindful that dividing by one thousand can give some results that may be difficult for students to understand, and is more careful to point out what should be excluded from this section. The New Zealand document would benefit greatly from inclusion of this kind of qualifying statement. This is evident if extracts from the three countries are placed alongside each other:

Japan

Grade 5

Contents

Numbers and calculations

- (2) Children should deepen their understanding of integers and decimals through thinking about how they are represented, and should make use of them effectively in calculations and so forth.
 - a) To create numbers 10 times, 100 times, one-tenth and one-hundredth the size of a number, and to investigate the relationship between them.

Singapore

Primary 5

Decimals

Multiplication and division

- Multiply and divide decimals up to 3 decimal places by tens, hundreds and thousands.

(Exclude cases where the first non-zero digit in the answer is at the 4th decimal place, such as $0.12 \div 1000 = 0.00012$.)

New Zealand

Level 4

Suggested learning experiences

Exploring number

- investigating the results of multiplying and dividing decimals by powers of 10 (10, 100, 1000).

However, there are other areas where the New Zealand document could be more attuned to the results of research into children's difficulties in understanding decimals. For example, the Victorian CSF II, under its Learning Outcomes for Level 4 (to be achieved by most students by the end of Year 6), draws attention to the importance of students being able to "compare and order decimal fractions with unequal numbers of places (eg 3.05, 3.001, 4.4, 3.12)". Current research, for example, by Stacey, Helme and Steinle (2001) and Stacey and Steinle (1999, 1998), is quite emphatic in showing how students who may appear to be quite confident in comparing and ordering decimals with the same number of decimal places can be quite confused when confronted by decimals with an unequal number of places.

There are several reasons for this, but perhaps one of the most important is that, while students can model whole numbers using relatively simple models, modelling fractions and decimals is quite different. Some children try to transfer their whole-number understanding to decimal numbers, with serious misconceptions resulting. Think of those children who believe that the more digits after the decimal point the larger the value of the decimal. This kind of thinking is not without its own logic, since the more digits or numerals *before* the decimal point the bigger the number. So why should this not be the case after the decimal point? These children typically think that 1.25 is larger than 1.4, and may even say the first number as 'one point twenty-five'. To its credit, the New Zealand document alerts teachers to this incorrect reading on page 41. However, in the light of recent research, more careful teaching must be directed to overcoming these and other strong misconceptions about decimals.

Decimal numbers involve a major development of the base-ten system to incorporate tenths, hundredths and so on. Some models appear attractive to students (and to some teachers), but ultimately defeat themselves. Dollar-and-cents thinking is sometimes used by students and teachers as a neat way of ordering one and two decimal place numbers. This model does not help students to think of the numbers after the decimal point as tenths and hundredths. Students who use this model often think that 3.42 and 3.4256 are really the same, that is, they can both be thought of as \$3.42. “Those extra bits on the end don’t matter.”

Furthermore, a completely new conceptual feature of fractions and decimals is that of *density*. In whole-number thinking, there is, for example, only one number that comes between seven and nine. And between seven and eight, there is no in-between number. By contrast, between any two fractions or decimals there is no limit to how many numbers are in between. A circle or pie model of fractions does not help children readily to see this feature. A number line is able to provide a more useful way of modelling density. The dollar-and-cents model of decimals does not illustrate density because there is no amount between ‘3 dollars 42 cents’ and ‘3 dollars 43 cents’. Curriculum documents and textbooks must bring these issues before teachers.

4.2.6.3 Summary

The review by Professor Geoffrey Howson in 1994 gave a fair but somewhat mixed report card to *Mathematics in the New Zealand Curriculum*. Many of the structural issues that he raised then about a ‘levels’ model remain today. The adoption of a ‘levels’ model has to reconcile its broad focus on student learning and achievement with the provision of clear and unambiguous advice to teachers and curriculum planners about what to teach, when to teach, and how to teach.

In terms of specifying key elements of content in the chosen area of decimals, the 1992 document compares reasonably well with equivalent documents in Victoria, Japan and Singapore.

In terms of specifying when this content should be taught, the New Zealand document appears to leave this decision to individual teachers and schools. This degree of local flexibility is, as Howson implies correctly, a ‘big ask’ for busy teachers and school mathematics coordinators. It is clearly not an approach endorsed by the other three documents, with Japan and Singapore both opting for clear content specifications by Grade/Year level.

How clearly and unambiguously is content elaborated in the New Zealand document? Generally speaking, the answer to this question has to be a ‘satisfactory’, but the degree of detail is not as strong as in the other three documents. In the Victorian CSF II, which has opted for a ‘levels’ approach, there are a number of features that could be attended to in a New Zealand document. In the first place, the Victorian CSF II introduces each level with a statement of curriculum focus. While both documents seem to use the expressions

“achievement objectives” (New Zealand) and “learning outcomes” (CSF II) in approximately similar senses, the Victorian document gives a more detailed elaboration through its use of “Indicators”, which exemplify more specifically performances typical of students who have reached a given level. The effect of introducing these indicators gives a sharper degree of specificity and clarity to the Victorian document than is present in the New Zealand one. For example, the treatment of decimals in the Victorian CSF II across Levels 3, 4 and 5, in terms of Outcomes and Indicators, is shown in Table 3. In all, 30 indicators can be identified across the three levels. This provides teachers with a much higher degree of detail than has been achieved in the New Zealand document.

Table 3: Victorian CSF II decimals – outcomes and indicators

Level and Strand	Outcomes	Indicators
<i>Level 3</i>		
Number, counting and numeration	1	5
Computation and applying number	1	1
<i>Level 4</i>		
Number, counting and numeration	2	7
Mental computation and estimation	2	2
Computation and applying number	1	2
Number patterns and relationships	1	2
<i>Level 5</i>		
Number, counting and numeration	2	4
Mental computation and estimation	2	3
Computation and applying number	2	4

The New Zealand document is not so clear on the appropriate Grade/Year at which children should be introduced to decimals. This is considered to be a major weakness of any national curriculum document. It is an important issue for both teachers and parents. It has already been noted that Singapore appears to introduce decimals a year later than Victoria and Japan. This delayed treatment can be defended in terms of the priority given to the treatment of fractions in the Singapore document. But all three documents provide teachers with clear advice on where the teaching of the topic is expected to start.

How well does the New Zealand document advise teachers on an appropriate sequencing of the topic? Since the topic of decimals appears in only two Levels of the New Zealand document, there is no strong sense of development across Year/Grade levels. In the Victorian document, the same topic is treated over three Levels, with a clearer sense of development from Year 4 to Year 8. In Japan, the same topic is considered over three Grades. In Singapore, the topic is elaborated over Primary 4 and 5 and in Secondary 1.

How well does the New Zealand document assist teachers to understand the complexities of the topic in ways that will assist them to plan effective instruction and to

respond to students' misconceptions? The answer here appears to be "Not well at all". The Japanese and Singapore documents are much stronger in elaborating how a topic is to be taught, and how to attend to its key ideas. The Victorian CSF II, by listing "indicators" of performance appears to be better placed to alert teachers to key issues to be addressed and to possible areas where students will need support.

It may well be that New Zealand opts to stay within a 'levels' model. If this is the choice, then within that model there appears to be a case for much clearer articulation of content and where teaching is recommended to start. There is also much to learn from the two Asian documents on how content is to be sequenced across Year/Grade levels, and how the key ideas are to be attended to. Teachers deserve nothing less than this. At the time of its publication in 1992, *Mathematics in the New Zealand Curriculum* compared favourably with similar documents in Australia and other countries, as Howson (1994) noted. In 2002, those strengths are no longer so convincing. Other countries have moved forward and are looking to strengthen their positions further.

CHAPTER 5

RECENT DEVELOPMENTS IN SOME ASIAN EDUCATION SYSTEMS

Some advocates of the New Zealand outcomes-based approach to curriculum defend it by arguing that successful education systems in countries like Singapore, Korea and Japan are forsaking the more traditional syllabus approach in favour of the New Zealand model. A superficial reading of recent developments suggests that this might be the case.

Over the last four to five years many Asian education systems have undergone significant curriculum review. As in Japan's 'Education Reform Plan for the 21st Century', Hong Kong's report 'Learning for Life, Learning Through Life', the development of Korea's seventh curriculum or Singapore's report 'Thinking Schools, Learning Nation', some Asian systems are arguing that they should adopt more innovative, creative approaches to teaching and learning.

Does this admission mean that systems such as the Korean and Singaporean are about to follow in New Zealand's footsteps? The following arguments suggest that the answer is 'no'.

First, syllabus-adopting countries such as Korea, Hong Kong and Singapore do exceptionally well in international tests such as TIMSS where they consistently outperform countries such as New Zealand, the United States and Australia. Given the increasing importance of knowledge-based industries in ensuring economic success, it would be strange if successful systems were to forsake what gives them a competitive advantage over an outcomes-based approach that, as shown by the United States experience, is something demonstrably less successful.

Secondly, in discussions during 2000 in Seoul with Dr Do-soon Park, the Director of the Korea Institute of Curriculum and Evaluation (KICE), it became obvious to the author that Korean educators prefer a standards approach to curriculum design rather than an outcomes approach, which they consider to be inferior. In developing their seventh curriculum, KICE officials undertook a comparative analysis of a range of education systems around the world. Such research drew largely on events in the United States, where outcomes-based education has been heavily criticised in favour of the more recent standards approach (see section 3.4).

Thirdly, while the rhetoric is one of the importance of 'life-long learning' and promoting the 'joy of learning', the fact is that systems such as the Singaporean still adhere to approaches to teaching and learning that contrast with New Zealand's outcomes approach. Streaming versus mixed-ability classes offers a case in point. One of the defining characteristics of an outcomes-based approach to education is forsaking the streaming of students in terms of ability; the ideal is one of mixed-ability learning where

students with a full range of abilities and interests are together in the one class and the one school. If Singapore were adopting the New Zealand approach, we would expect that Singapore's Ministry of Education would forsake streaming in favour of mixed-ability classes, but this is not the case. As stated by Singapore's Minister for Education:

Our streaming system more closely matches curriculum and the pace and method of learning with the abilities and aptitudes of our children so that each student can proceed at his or her own pace. Those members who have expressed concern that our curriculum appears to be catering only to the most able students should therefore be strong advocates of streaming as it addresses precisely this concern. As a system, streaming is better than requiring every student to fit into only one prescribed programme of study. Indeed, the more customised education becomes, the more streams will emerge. Through streaming and giving those who need it a lighter curriculum or more time, we have reduced educational wastage and successfully raised the educational attainment of our students. In 1980, before streaming, only 58 percent of a P1 cohort completed secondary school. By 2000, the proportion was 93 percent (Teo Chee Hean, 2001).

It should also be noted that, while most systems that have adopted an outcomes approach have one common certificate for all students in middle and upper secondary school, systems such as the Singaporean still have a number of distinct and different certificates to meet the range of student abilities, interests and post-school destinations.²³ Thus, in Singapore, students are able to select from the Special Course, the Express Course or the Normal Course during their years of secondary school. Singapore also still requires senior students who seek university entry to undertake the International General Certificate of Secondary Education, the Advanced Subsidiary (AS) and the Advanced (A) level examinations offered by the Cambridge University examinations syndicate.

Fourthly, discussions between the author and educationalists in Hong Kong, including Mr CC Choi, the secretary of the Hong Kong Examinations Authority, suggested that while there will be a greater emphasis on more creative approaches to teaching and learning, in particular to assessment and testing, there is a recognition that progressive reforms should not simply mimic an outcomes-based approach prevalent in countries such as New Zealand. While New Zealand lacks consistent and regular testing, the Hong Kong school system, for example, will still have 'high stakes' normative tests during the

²³ Of interest is that in the United Kingdom the Labour Party's Green Paper on school education, released in 2001 before the general election, argued that comprehensive schools in England and Wales had failed and that schools should adopt various certificates and approaches to suit the full range of student abilities, interests and post-school destinations.

senior years of schooling. New Zealand, by contrast, is implementing the NCEA, which involves moving from norm-referenced assessment to criterion-referenced assessment.²⁴

Finally, some 'Western' educators criticise 'Asian' school systems for over-emphasising more traditional approaches to classroom pedagogy such as rote learning and whole class, didactic teaching. Recent research, in particular that associated with the TIMSS ethnographic studies of classrooms in Germany, Japan and the United States, shows that this view of 'Asian' education is misplaced. In fact, it is not Japanese classrooms, but US schools that are criticised for adopting sterile and ineffective classroom practices:

What we can see clearly is that American mathematics teaching is extremely limited, focused for the most part on a very narrow band of procedural skills ... Japanese teaching [is] teaching for conceptual understanding. Students in Japanese classrooms spend as much time solving challenging problems and discussing mathematical concepts as they do practising skills (Stigler and Hiebert, 1999, p 11).

Reynolds (1996, 1998), in his analysis of what constitutes an effective classroom, also notes the dynamic, interactive nature of the 'Asian' classroom, one where there is a high degree of interaction and conceptual learning. In part, this is because teachers generally begin classes by asking a hypothetical question or by posing a particular challenge. Then students, and the class as a whole, are led through a process of enquiry in an attempt to find a way forward and/or a solution.

As noted by Marton, Dall'Alba and Kun (1996) in their research about the role and nature of rote learning and memorisation in Asian classrooms, it is also wrong to assume that because Asian students, when compared with Western students, rely more on memorisation that this means there is less deep learning:

These results [of the research] enable us to see that the traditional Asian practice of repetition or memorization can have different purposes. On the one hand, repetition can be associated with mechanical rote learning; on the other hand, memorization can be used to deepen and develop understanding. If memorization is understood in this latter way, the paradox of the Asian learner is solved (Marton, Dall'Alba and Kun, 1996, p 82).

Further evidence that it is simplistic to criticise Asian classrooms for relying too much on rote-learning and more formal, didactic forms of teaching and learning can be found in the results of the Programme for International Student Assessment (PISA) 2000 (see also appendix B). While tests such as TIMSS relate to the formal school curriculum, PISA

²⁴ For a summary and critique of the NCEA, see Education Forum (2000), *What Teachers and Parents Should Know About the National Certificate of Educational Achievement (NCEA)*, Education Forum, Auckland (accessible at www.educationforum.org.nz).

sought to assess the type of skills and understanding associated with the so-called 'real world' situations found outside the classroom. In the words of a US document:

... Other national and international studies have a strong link to curriculum frameworks and seek to measure students' mastery of specific knowledge, skills and concepts. PISA is designed to measure 'literacy' more broadly ... in the context of every day situations (National Center for Educational Statistics, 2002, p 2).

Given PISA's emphasis on assessing the type of skills and understanding associated with what some consider more creative, independent thinking, it should follow that Asian students, burdened as they apparently are by more traditional forms of teaching and learning, would not perform well. In fact, in relation to both mathematics and science literacy, Japan and Korea ranked in the top two positions.

In an attempt to justify the progressive, child-centred and constructivist approach to curriculum development evident in New Zealand, it might be tempting for some to argue that Asian countries are forsaking their more traditional approach in favour of New Zealand's preferred approach. Such a view is incorrect and demonstrates a superficial understanding. Not only do Asian systems generally maintain a commitment to streaming and separate certificates for students of different abilities and interests, but they also remain committed to regular, norm-referenced testing. Finally, where authorities acknowledge shortcomings in their current education system, the response has been to look to a standards approach, and not New Zealand's 'outcomes' approach, as the way forward.

CHAPTER 6

CONCLUSION

Education systems around the world are involved in a good deal of curriculum renewal and reform. Generally speaking, an essential aspect of such work is 'benchmarking' local curriculum against what are considered to be the best equivalent documents found overseas. In developing the New Standards curriculum in the United States, the organisations responsible for the Standards, the National Center on Education and the Economy and the Learning Research and Development Center at the University of Pittsburgh, state that a critical part of the development process was to ensure that the "... standards have been benchmarked to the expectations of those countries with the highest student performance in the world".²⁵

As stated by the American Federation of Teachers:

If standards truly are rigorous and world class, they should stand up to some tough but sensible questions:

- do they reflect various levels of knowledge and skills comparable to what students in high-achieving countries are expected to master?
- which countries did the standard-setters use as a basis for comparison, and what documents from these countries did they look at to determine their standards?
- will the standards lead to a core curriculum for all students – those headed for college and those headed for work – as demanding as those in France or Japan? (AFT, 1993)

The Ministry of Education, while appearing to agree with the need to undertake a comparative analysis to ensure that New Zealand's curriculum framework and statements are truly the 'world's best', the fact is that it has thus far shown little, if any, desire to strengthen the New Zealand curriculum by addressing the type of criticisms outlined above. While nodding in the direction of international evaluation, the statement quoted earlier (section 1) from the 'Curriculum Stocktake' internet site, about this being a "time of consolidation and reflection" and not for "rush[ing] into revision" suggests that things will remain much as they are and that there will be little, if any, serious attempt to strengthen and improve the New Zealand curriculum.

That this should be a concern is underscored by the fact that New Zealand's new curriculum framework and statements represent an obsolete and sub-standard form of developing and implementing the curriculum. As concluded in section 4.2.6, even one of

²⁵ See the New Standards Internet site <<http://www.ncee.org/OurPrograms/nsPage.html>>.

New Zealand's better specified and stronger curriculum statements, the one for mathematics, has fallen behind developments elsewhere.

Any genuine attempt to 'benchmark' the New Zealand curriculum should investigate the range of methodologies now available to undertake a rigorous and effective comparative analysis of curriculum (one example of such a methodology is provided as appendix A). To refuse to undertake such a 'benchmarking' exercise and to refuse to identify and correct the many flaws and faults evident in the New Zealand curriculum will have a number of consequences. Not only will such short-sightedness adversely affect New Zealand's ability to survive in an increasingly competitive global environment, but, worse, generations of students will also be forced to complete an educational experience impoverished by a curriculum that is both outdated and seriously flawed.

APPENDIX A

THE METHODOLOGY USED TO 'BENCHMARK' THE VICTORIAN CURRICULUM AND STANDARDS FRAMEWORK

The following is a brief outline of the methodology, developed by Dr Kevin Donnelly, Executive Director, Education Strategies, used to 'benchmark' the Victorian Curriculum and Standards Framework for Victoria's Ministry of Education.

Benchmarking the Victorian Curriculum and Standards Framework

In evaluating Victoria's curriculum the following points need to be addressed:

- 1 What is taught and how it is assessed – the stated curriculum.
- 2 How it is enacted in the classroom – pedagogy.
- 3 Expectations about what students should have learned – outcomes.
- 4 The intended levels of achievement – standards.
- 5 The actual levels of achievement – performance.

Given the definition of curriculum used in the TIMSS research, the previous five points can be grouped in the following way:

- 1 The intended curriculum
 - What is taught and how it is assessed – the stated curriculum.
 - Expectations about what students should have learned – outcomes.
 - Intended levels of achievement – standards.
- 2 Implemented curriculum
 - How it is enacted in the classroom – pedagogy.
- 3 Attained curriculum
 - Actual levels of achievement – performance.

Benchmarking Victoria's curriculum involves evaluating each of the five points identified above, in the following way:

1 What is taught and how it is assessed

Defined narrowly, the stated curriculum relates to textbooks, curriculum guides, frameworks and syllabuses that detail what is to occur in the classroom. Traditionally,

such documents have been 'input' focused, and sought to define a particular area of study, subject or discipline.

Benchmarking the stated curriculum can be achieved by:

- asking experts what constitutes a world-class curriculum in terms of what is taught and how it is assessed and judging how the CSF and related textbooks and guides compare;
- detailing what best constitutes particular forms of knowledge, subjects and/or disciplines and evaluating how the CSF and related textbooks and guides compare; and
- comparing the CSF and related textbooks and guides against what are considered to be the world's best equivalent documents. Any comparison should address such matters as difficulty, scope, sequence and coverage of what is taught and assessed.

2 How the curriculum is enacted in the classroom

It cannot be assumed that the intended curriculum is always successfully enacted in the classroom. The challenge then becomes one of establishing the current state of play in Victorian classrooms by finding out to what extent, and in what way, the intended curriculum is being implemented and whether Victorian classroom pedagogy conforms to best practice.

Benchmarking teaching and learning practice (pedagogy) can be achieved by:

- establishing what actually is or is not occurring in Victorian classrooms. Models of teaching and learning should be identified as well as underlying values and beliefs about the nature of learning;
- establishing, in the light of research, what constitutes best practice pedagogy; and
- using data collected from the Office of Review to identify those schools and teachers that appear most effective in adding value to student learning and that could be used as exemplars for the system as a whole.

3 Expectations about what students should have learned – outcomes

Traditionally, particular subjects or disciplines have been the starting point for the educational process. More recently, Australian documents like the national curriculum statements and profiles have emphasised an outcomes-based approach to curriculum design – shifting the emphasis from 'what should be taught' to 'what should students have learned'.

Benchmarking expectations about outcomes can be achieved by:

- comparing the CSF against what are considered to be the world's best equivalent documents;

- any comparison should address such matters as:
 - whether the CSF covers too much ground at particular stages and whether, as a result, students are not receiving a deep enough understanding and appreciation of foundation content and skills;
 - whether the CSF satisfactorily introduces and sequences the knowledge, understanding and skills associated with key disciplines/areas of knowledge; and
 - whether the CSF outcomes are explicit enough, easily understood and able to be enacted in the classroom.

4 The intended levels of achievement – standards

Different countries define and measure ‘standards’ in different ways. In relation to the CSF the statement is made that “standards are expressed in terms of ‘learning outcomes’ “ .

Benchmarking the intended levels of achievement in the CSF can be achieved by:

- identifying the intended levels of achievement as stated in the CSF and comparing them against the world’s best equivalent documents. Comparisons should address such matters as:
 - whether the standards (outcomes) as expressed in the CSF are suitably challenging and rigorous;
 - whether the CSF standards (outcomes) are explicit enough; and
 - judging whether the way in which standards are established, put into practice, monitored and refined conforms to best practice.

5 The actual levels of achievement – performance

Given the impact of international tests such as TIMSS and the emphasis on accountability and effectiveness, all education systems are seeking to improve levels of student performance.

Benchmarking the actual levels of achievement in the Victorian curriculum can be achieved by:

- comparing and evaluating Victoria’s current approach to measuring student achievement against the world’s best practice;
- establishing, in the light of research, what constitutes ‘best practice’ approaches to performance measurement; and
- monitoring and evaluating the performance of Victorian students in the context of international assessment and testing programmes.

APPENDIX B

PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT

As this paper was being written the results of the Programme for International Student Assessment (PISA) 2000 were released. Sponsored by the Organisation for Economic Cooperation and Development (OECD), PISA 2000 is an international test across 32 countries measuring the literacy performance of 15 year olds. Given New Zealand's strong performance in PISA,²⁶ where students were ranked third on the mean reading literacy scores, the argument could be advanced that all is well with New Zealand's curriculum framework and that the type of criticisms outlined in this paper (in part, based on New Zealand's relatively weak performance in both TIMSS and TIMSS-R) are erroneous. While acknowledging New Zealand's success in PISA, it should also be acknowledged that PISA is not as strong and credible an indicator of educational success as TIMSS and TIMSS-R.

First, four countries that consistently outperform New Zealand in international tests (Hong Kong, Singapore, Taiwan and the Netherlands) were not included in the PISA results. If students from these countries had been included, then the relative position of New Zealand would, in all probability, have suffered.

Secondly, as acknowledged by those involved in developing and reporting on PISA, there are a number of qualifications expressed as to the credibility and veracity of the rankings associated with the assessment. As stated in the Executive Summary prepared by the OECD:

Since PISA is a sample survey, the resulting estimates are associated with some level of uncertainty (OECD, 2002, p 8).

That care should be taken in relying on the PISA results to rank the performance of particular countries is also noted in the UK summary of that country's results:

... the actual rankings are not meaningful in themselves. This is because the data presented in this report are obtained from samples, and sampling error must be taken into account when considering the results: differences between countries may be very small, and even if apparently larger, may not be statistically significant (National Statistics, 2001, p 6).

To some extent such caveats also apply to TIMSS and TIMSS-R. However, the sampling for PISA was not as extensive as that for TIMSS and TIMSS-R, therefore more caution is required in drawing conclusions from its results.

²⁶ For an outline of New Zealand's performance in PISA see: <http://www.minedu.govt.nz/web/document/document_page.cfm?id=6489>.

Thirdly, as already mentioned in this paper, PISA did not measure the traditional school curriculum. In the words of those responsible for PISA:

PISA assessed young people's capacity to use their knowledge and skills in order to meet real-life challenges, rather than merely looking at how well they had mastered a specific school curriculum (OECD, 2002, p 2).

Instead of measuring academic content and skills, as do tests such as TIMSS and TIMSS-R, the approach adopted by PISA emphasised process and the types of understanding associated with what are termed "everyday situations". Given the type of progressive, constructivist, child-centred approach adopted by the New Zealand curriculum framework, it should not be surprising that New Zealand students appeared to do so well – as argued below by a Canadian commentator, Malkin Dare, in respect of her own country's students. It is as though the PISA test was specifically designed to advantage systems that have adopted an 'outcomes' approach to curriculum design. One example of this curriculum bias relates to an understanding of the more formal aspects of reading and writing. Notwithstanding the fact that the major emphasis of PISA was on literacy, it is clear that students were not penalised for spelling or grammatical mistakes. As stated in the UK report, on outlining the range of tasks students were expected to complete:

- reading: the ability to understand, use, and reflect on written texts to participate effectively in life (it – PISA – does not seek to measure the extent to which students are fluent readers or their ability in spelling and word recognition) (National Statistics, 2001, p 2).

While there are those in the 'real-world', such as parents and employers, who consider that good literacy includes correct spelling and grammar, those responsible for developing PISA obviously had other ideas as evidenced by the following quotation from the Australian report:

Errors in spelling and grammar were not penalized in PISA – if they had been, probably all countries' achievement levels would have gone down, but there is no doubt that Australia's would have. It was the exception rather than the rule in Australia to find a student response that was written in well-constructed sentences, with no spelling or grammatical error (Lokan, Greenwood, Cresswell , 2001, p 210).

Given the similarities in curriculum development and the approaches to teaching and learning English between Australia and New Zealand, one wonders whether the same comment applies to New Zealand students.

A Canadian comment: PISA Criticisms

The latest international test is very different from those that went before. The test makers explicitly say this. The test is designed to evaluate students' "capacity to use their knowledge and skills in order to meet real-life challenges, rather than merely looking at how well they had mastered a specific school curriculum." The testmakers wanted to know if students could do such things as retrieve specific information, develop interpretations, and reflect on the content or form of a text. These sorts of abilities were evaluated because they are believed to be the skills that are necessary for succeeding as adults. Sample questions may be found at www.pisa.oecd.org, click on 'What PISA Assesses' and then click on 'Sample Tasks'.

The test is thus almost completely oriented to processes. The sample questions are based on quite easy material. There is a range of difficulty, but I would estimate that the readability level of the most difficult passage to be no more than grade 6, probably less. Similarly, in math, the most difficult arithmetic involved multiplying a two-digit number by a two-digit number (I don't know whether calculators were allowed). Many of the questions were multiple choice; the questions that required a written response could be satisfactorily answered in perhaps a dozen words, spelling and grammar being of no consequence. Virtually no scientific knowledge was needed.

This means that the traditional domains of international testing, such as reading complex material, doing calculus, or drawing on knowledge of the third law of thermodynamics, were not assessed at all. It means that the strong ability of students in countries such as Japan was not tapped.

Many of the questions involved the sorts of things Canadian children routinely do in school – give their opinions on pollution, find nutrition information on a cereal box, etc. It is not surprising that Canada stood high in the rankings. It is as if this test were tailor made to make Canada look good.

An analogy might be to a music student who was deficient in technical skill, knew very little music theory, but who had incessantly practised one particular piece to the point that he could play it beautifully. Along comes the music examiner and all she asks the student to do is to play that piece. The student gets a high mark. Meanwhile, other music students with much greater overall capabilities have played this particular piece only once or twice. They get a lower mark. The latest international comparison is giving us good reliable valid information. But it is important that we understand what the information is.

Malkin Dare

Organization for Quality Education, www.oqe.org

APPENDIX C

DETAILED MATHEMATICS CITATIONS

Japan

Mathematics Program in Japan: Elementary, Lower Secondary and Upper Secondary Schools (Japan Society of Mathematical Education, 2000).

Grade 3

1. Objectives

- (1) Children should be able to add and subtract appropriately, deepen understanding of multiplication, and be able to multiply appropriately. Children should understand the meaning of division, and should make the methods of division and should make use of it.

...

Contents

A Numbers and Calculations

- (1) Children should deepen understanding of how to express numbers and extend the ability to make use of them
 - a) To understand the unit ten thousand
 - b) To know the size of numbers multiplied by 10 or 100, or divided by 10 and how to express them (p 10).

Grade 4

1. Objectives

- (1) ... (Children) should understand the meaning of and how to display decimals and fractions, understand the meaning of adding and subtracting decimals, consider how to do these calculations, and to be able to use them appropriately (p 12).

Contents

A Numbers and Calculations

- (4) Children should understand the meaning of decimals and how to express them, should understand the meaning of adding and subtracting decimals, and should be able to perform these calculations.
 - a) To use decimals to express the size of remainders. To know how to express decimals and the one-tenths position.

- b) To know that decimals are expressed in the same manner as integers, and to deepen understanding of the relative size of numbers.
- c) To make methods of the addition and subtraction of numbers down to the one-tenths position, and to be able to perform these calculations (p 13).

Grade 5

1 Objectives

- (1) ... Children should deepen understanding of the meaning of fractions and decimals and how to express them. Children should understand the meaning of multiplying and dividing decimals, should think about these calculations, and should be able to make use of them in an appropriate manner (p 16).

Contents

A Numbers and Calculations

...

- (2) Children should deepen their understanding of integers and decimals through thinking about how they are represented, and should make use of them effectively in calculations and so forth.
 - a) To create numbers 10 times, 100 times, one-tenth and one-hundredth the size of a number, and to investigate the relationship between them.
- (3) Children should understand the meaning of multiplication and division, and should make use of them appropriately.

...

- b) To understand the meaning of multiplication and division when the multipliers and divisors are decimals, **based on an understanding of multiplication and division for integers** [emphasis supplied].
- c) To think about how to perform multiplication and division on decimals, and to be able to perform these calculations. To understand the size of the remainder.
- (4) Children should deepen understanding of fractions ...
 - b) To convert integers and decimals into fractions, and to express fractions in decimals (p 16).

Grade 6

Contents

- 1. Children should deepen understanding of addition and subtraction of fractions, and should be able to make use of these appropriately; understand the meaning of

multiplying and dividing fractions, should make methods of calculations, and make use of them appropriately.

...

A Numbers and Calculations

- (3) Children should understand the meaning of multiplying fractions, and to be able to do these calculations appropriately.
- b) To understand the meaning of multiplication and division when the multipliers and divisors are fractions, **based on an understanding of calculations when the multipliers and divisors are integers and decimals** [emphasis supplied].
 - c) To think about multiplication and division with fractions, decimals, and to be able to do these calculations (p 18).

Singapore

The primary school years in Singapore are organised from P1 to P5. With two years being spent in pre-school, P1 students are typically aged seven years plus. From an Australian perspective, P1 equates roughly to Year 2 and P5 to Year 6. The following are extracts from the Singaporean Primary School Syllabus (www.moe.edu.sg/syllabuses).

Primary 3

Equivalent fractions

- Recognise and name equivalent fractions (include numerator and denominator).
- List the first eight equivalent fractions of a given fraction with denominator not greater than 12.
- Write the equivalent fraction of a (given) fraction given the numerator or denominator.
- Express a fraction in its simplest form.

Comparing and ordering

- Compare and order related and unlike fractions with denominators up to 12. (Include both increasing and decreasing order, number of fractions involved should not exceed 3.)

Primary 4

Decimals

Number notation and place value

- Read and interpret decimals up to three decimal places.

(Include use of the number line to illustrate concept of decimals, Include identifying the values of digits in a decimal, Include sums such as the following):

(i) $0.125 = 1/10 + 2/100 + \square/1000$

(ii) $0.125 = 125/\square$

(iii) $21.203 = 21 + \square/200$

(Exclude $0.125 = 1/10 + 1/50 + \square/200$).

- Compare and order decimals.

Addition and subtraction

- Add and subtract decimals up to 2 decimal places.

(Include mental calculations involving addition and subtraction of 1-digit whole numbers/tenths and tenths).

Multiplication and division

- Multiply and divide decimals up to 2 decimal places by a 1-digit whole number.

(Include division of a whole number by a whole number with decimal answers, Include rounding off answers to 2 decimal places, Include checking reasonableness of answers.)

Conversion between decimals and fractions

- Express a decimal as a fraction and vice versa.

Approximation and estimation

- Round off decimals to:

– the nearest whole number

– 1 decimal place

– 2 decimal places.

(Include units of measure.)

- Estimate the answers in calculations involving addition, subtraction and multiplication.

(Include checking reasonableness of answers.)

Word problems

- Solve up to 2-step word problems involving decimals.

(Include rounding off answers to a specified degree of accuracy, Include checking the reasonableness of answers.)

Primary 5

Decimals

Multiplication and division

- Multiply decimals up to 2 decimal places by a 2-digit whole number.
(Include checking the reasonableness of answers by estimation.)
- Multiply and divide decimals up to 3 decimal places by tens, hundreds and thousands.
(Exclude cases where the first non-zero digit in the answer is at the 4th decimal place, such as $0.12 \div 1000 = 0.00012$.)
- Solve word problems involving decimals.
(Include rounding off answers to a specified degree of accuracy. Include checking reasonableness of answers.)

Secondary 1

Fractions and decimals

Concept and notation

- use fractions and decimals
- convert fractions to decimals and vice versa.

Ordering

- compare and order fractions and decimals.

The four operations

- use the four operations for calculations with fractions and decimals etc.

New Zealand

Level 2 (Approximately Years 4/5)

Nothing specifically on decimals.

Note that decimals are introduced in Year 4 in Japan, in Year 5 in Singapore, and in Year 4 in Victoria, Australia.

Level 3 (Approximately Years 6/7)

Achievement objectives

Exploring number

- explain the meaning of the digits in decimal numbers with up to three decimal places;
- order decimals with up to three decimal places.

Exploring computation and estimation

...

- write and solve problems which involve whole numbers and decimals and which require a choice of one of the four arithmetic operations;
- solve practical problems which require finding fractions of whole numbers and decimal amounts.

Suggested learning experiences

Exploring number

...

- developing meaning for decimal place values, using concrete models and a calculator, for example, using place-value blocks, repeated division by 2 leading to 4, 2, 1, 0.5, 0.25, 0.125, 0.0625;
- saying decimals, for example, 1.25 is one and twenty-five hundredths, or one and two tenths and five hundredths, or one hundred and twenty-five hundredths; 1.25 is read 'one point two five', not 'one point twenty-five';
- writing decimals in words and symbols;
- using calculators and number lines (rulers and other linear scales) to compare and order decimals;
- exploring number patterns which involve both whole numbers and decimals;
- investigating possible ways of renaming numbers using decimals. For example, $1 = 0.4 + 0.6$, $1 = 0.2 + 0.2 + 0.2 + 0.2 + 0.2$, $1 = 0.12 + 0.88$, $1 = 0.346 + 0.237 + 0.417$.

Exploring computation and estimation

...

- working with whole numbers and decimals;
- using calculators, concrete materials, and mental methods to find fractions of whole numbers and decimal amounts (including money and measurements).

Sample assessment activities

Explain in their own words which four in 0.444 has the greatest value.

Working in groups, measure their heights in metres (to two decimal places) and order the group from smallest to largest.

Solve problems from information presented in table form. For example, the scores from a gymnastics competition (see Pukerua Bay Gym Competition, p 42).

Level 4 (Approximately Years 7/9)

Achievement objectives

Exploring number

...

- express a fraction as a decimal, and vice versa;
- express a decimal as a percentage, and vice versa.

...

Exploring computation and estimation

...

- write and solve problems involving decimal multiplication and division.

...

Suggested learning experiences

Exploring number

...

- relating fractions to decimals;
- ...
- saying decimals as percentages, for example, 0.43 is 43%;
- ...
- investigating the results of multiplying and dividing decimals by powers of 10 (10, 100, 1000).

Exploring computation and estimation

- ...

- exploring the outcomes of multiplication and division using decimals;
- devising and using strategies for estimating the results of computations involving decimals;
- solving and writing problems involving the multiplication and division of decimals;
- ...

APPENDIX D

EDUCATION FORUM

The Education Forum has been formed to contribute to education policy through research and debate on the current issues, structures, and expectations at all levels of New Zealand education.

The Forum believes that New Zealand education requires an approach to learning and achieving which encourages all individuals to reach their full potential, and which will take New Zealand to the leading edge of international performance and achievement.

The Forum is an association of individuals who have a common concern for the future direction of New Zealand education. The membership is drawn from primary, secondary and tertiary sectors of education, together with leaders of industry and commerce.

The principles incorporated in the above statements include the following:

- A commitment to excellence and high expectation in all human endeavour, based on a lifelong desire for learning.
- The belief that the community/government should ensure that all young New Zealanders have access to quality education.
- The teaching of values and life skills which will preserve the dignity of the individual and the integrity of the family.
- The acceptance of healthy competition for both individuals and the education sector.
- The encouragement of cooperation, creativity, adaptability and enterprise.
- The encouragement and recognition of personal responsibility, goal setting and achievement in all endeavours, through self-discipline and hard work.
- The acceptance of a compulsory core curriculum in primary and secondary schools.
- The necessity for high standards of assessment of student performance and of accountability of teachers and institutions.
- The promotion of a New Zealand cultural identity.
- The key involvement and responsibility of parents in their children's education.
- The emphasis on the value of parental choice and the self-management of education institutions.
- The development of closer links between education institutions and industry.

PO Box 24–310, Wellington

APPENDIX E

MEMBERS OF THE EDUCATION FORUM

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Mr Simon Carlaw
Chief Executive
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Mrs Alison Gernhoefer
Principal
Westlake Girls' High School

Dr John Hinchcliff
Vice-Chancellor
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Mr Roger Kerr
Executive Director
New Zealand Business Roundtable

Mr John Morris (chairman)
Headmaster
Auckland Grammar School

Mr Roger Moses
Headmaster
Wellington College

Ms Joy Quigley
Executive Director
Independent Schools of New Zealand

Mr John Taylor
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