



Australian Government
**Department of Education,
Science and Training**

Benchmarking Australian Primary School Curricula

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**WHERE DO WE STAND?
THE INTENDED PRIMARY SCHOOL CURRICULA WITHIN AN INTERNATIONAL
CONTEXT**

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1. Executive Summary

The report is the result of a project funded by DEST, and completed by Education Strategies¹, to undertake a comparative analysis of intended primary school curricula in the areas of mathematics, science and English across Australian state and territory education systems as well as a selected number of overseas countries.

Reid (2005, p 11) defines the intended curriculum in the following way: “One approach is to understand curriculum as a noun. For example, many equate curriculum with a syllabus or framework. That is, curriculum is taken to mean an official document of stated curriculum intention”. While it is proper to define curriculum more broadly so as to include what actually occurs in the classroom (the enacted) and what students have learned and their level of achievement (the attained), the focus of this report is on the intended² primary school curriculum as represented by official syllabuses and framework documents.

It should also be noted, in relation to how well students learn and levels of achievement, that the intended curriculum, while being a necessary factor in strengthening outcomes, by itself, is insufficient. Notwithstanding the importance of the intended curriculum, such factors as what happens in the classroom and the impact of wider cultural and socio/economic influences also need to be considered.

In addition to analysing primary school curriculum documents, the report also makes a number of more general comments about the relative strengths and weaknesses of different models of curriculum development. Associated with this more general curriculum discussion is an analysis identifying the characteristics of those education systems that achieve strong results in international tests and a description of how such systems define and enact the intended curriculum³.

More specifically, the project’s brief is to:

1. identify the characteristics of those education systems that perform best in international tests such as the TIMSS and TIMSS-R,
2. identify how successful education systems define and enact the intended curriculum,
3. analyse the comparative strengths and weaknesses of curriculum documents in maths, science and English, and
4. evaluate the relative strengths and weaknesses of state and territory curriculum documents and suggest recommendations for improvement.

In response to international tests such as TIMSS and TIMSS-R, education systems around the world are also focusing on curriculum development in an attempt to raise standards and to

¹ While the project was managed by Education Strategies, Dr Max Stephens was involved in analysing and commenting on mathematics intended curriculum and Dr Christine Redman completed a similar task in relation to science. Dr Kerry Hempenstall provided valuable support in commenting on approaches to literacy learning in the early years of primary school.

² Researchers associated with TIMSS (Robitaille et al, 1993) differentiate between the intended curricula (represented by syllabuses and course outlines), the implemented (what is enacted in the classroom) and the attained (what students learn and levels of achievement).

³ Of value in undertaking this comparative analysis of curriculum is the work of the UK based National Foundation for Educational Research, see both the website <http://www.inca.org.uk/> and the publication *International Review of Curriculum and Assessment Frameworks* (NFER, 2004) <http://www.inca.org.uk/comparative.asp>

strengthen performance⁴. Vital in achieving this is a willingness to look outside territorial boundaries and to identify the characteristics of better performing countries and to adopt best practice. While Australian students generally perform well in international tests, of concern in relation to the most recent TIMSS results, is the fact that Australian students have not significantly improved their performance since the 1994/95 tests and we are now being outperformed by countries that were once below us in ranking.

As a result of the research associated with this report, it is possible to identify the characteristics of those education systems that, on the whole, outperform Australian students in international tests. In summary, more successful education systems⁵:

1. adopt a strong, discipline-based approach to school subjects focusing on essential learning. One of the flaws in Australia's adoption of outcomes-based education⁶, especially at the primary level, is that the intended curriculum fails to give students the necessary foundation knowledge, understanding and skills without which future success is unlikely,
2. provide clear, rigorous and concise intended curriculum documents linked to text books, teacher training and classroom practice. As evidenced by the analysis of the intended curriculum, see part 8 of the report, Australia's adoption of OBE leads to outcome statements that are generally vague, imprecise and lacking in academic content. Many of the Australian curriculum documents seek to remedy the problem of vague outcome statements by listing examples and indicators. Of concern, when compared to a syllabus approach, is that the practice overloads teachers with a hundreds of curriculum descriptors and there appears little, if any, epistemological justification for the examples given,
3. have greater time on task in the classroom, less disruption and a greater emphasis on formal, whole-class teaching. Ethnographic studies associated with TIMSS and TIMSS-R suggest that successful classrooms are those where there is a clear focus and expectation on what is to be achieved, teachers deal with conceptual understanding as well as developing skills, there is greater focus on teacher directed activities and there is less disruption and interruptions,
4. have regular testing and examinations used to stream students and to decide whether students should be promoted from year to year. One of the defining characteristics of OBE is the move away from summative assessment and examinations to formative, criteria-based assessment. As OBE outcome statements embrace a number of year levels and are often vague and general, there is less pressure on students to master learning within a set year level timeframe or consequences for failure, and

⁴ Examples of such research include: The TIMSS and PIRLS International Study Centre <http://isc.bc.edu/>, the Australian Council for Educational Research http://www.acer.edu.au/research/TIMSS/TIMSS_02_03.htm and the National Foundation for Educational Research <http://www.nfer.ac.uk/research-areas/international/>

⁵ While the intended curriculum analysis associated with this report focuses on the primary level, the following observations relate to primary and secondary education in general.

⁶ The Curriculum Council (1984, p 14) defines OBE in the following way: "An outcomes approach means identifying what students should achieve and focusing on ensuring that they do achieve. It means shifting away from an emphasis on what is to be taught and how and when, to an emphasis on what is actually learnt by each student". (See 7.1 of this report for a more detailed explanation of OBE. Lee, 2005, provides a useful historical overview of the emergence of OBE.)

5. have centrally controlled curriculum and examination systems where teachers and schools are given succinct, rigorous and teacher-friendly syllabus documents with less emphasis on school-based curriculum development. While school-based tests and examinations occur, the principal focus is on centrally devised system wide examinations at key stages.

In addition to identifying the characteristics of better performing education systems, this report has also benchmarked examples of state and territory intended curriculum documents against overseas documents. The methodology employed to analyse documents included:

1. identifying key curriculum descriptors, including where first introduced and subsequently dealt with,
2. identifying whether the difficulty inherent in the key curriculum descriptors develops across years/levels,
3. discussing the depth of coverage of these key curriculum descriptors throughout the documents; including time allocated,
4. examining the degree of academic rigour, detail, clarity and ease of measurement of the key curriculum descriptors, and
5. noting any significant discrepancies or differences of treatment between the Australian and international curriculum documents.

The following grids summarise the results of this comparative analysis in relation to point 4⁷ above:

Science

In relation to science, the two areas chosen for analysis are the physical world, in particular the areas of electricity, forces and light and sound and chemical matter, in particular properties and changes to matter. The rationale for selecting physics is because of the general disquiet concerning how physics is being taught in schools, as reflected by lack of student engagement and the low number of students studying physics, and the relative poor performance of Australian students when examined in these areas. Knowledge of chemistry is an important building block for successful studies in secondary school.

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

Physical World	Q'land	NSW	Vict	Tas	NT	SA	WA	Sing	Eng	Calif'
Detailed	***	***	**	**	***	***	***	*****	***	*****
Unambiguous	***	**	**	**	***	***	***	***	***	*****
Measurable	***	***	**	**	***	*****	*****	*****	***	***
Academic content	*****	**	**	**	***	***	*****	*****	***	*****

⁷ The more detailed and extensive analysis from which these grids arise is found in the second report associated with this project, entitled: *Where Do We Stand: Intended Curriculum Analysis*.

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

Chemical Matter	Q'land	NSW	Vict	Tas	NT	SA	WA	Sing	Eng	Calif'
Detailed	***	*	**	*	***	***	***	****	***	****
Unambiguous	***	**	**	*	***	***	***	***	**	****
Measurable	****	**	**	**	***	***	***	***	***	***
Academic content	****	*	**	*	***	***	***	***	***	****

Mathematics

In relation to mathematics, the areas chosen for analysis include: Number (Multiplication and Division; Decimals and Fractions – conceptual clarity, notation and operations); and Mathematical structure (especially as relating to arithmetical operations). The rationale for this selection is successful learning in Number is essential for all children, especially as they move from whole numbers to decimals and fractions, and from addition and subtraction to multiplication and division. Knowledge of mathematical structure comes from children's deep understanding of number in the primary school. It serves as the bridge to more formal algebraic thinking in early high school.

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

Multiplication and division	Q'land	NSW	Vict	Tas	NT	SA	WA	Sing	Japan	Calif
Detailed	**	**	**	*	*(*)	****	**	****	****	****
Unambiguous	**	**	**	*	*(*)	***	**	****	****	****
Measurable	**	**	**	*	**	***	**	****	****	****
Academic content	**	**	***	*	*	****	**	****	****	****

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

Fractions and decimals	Q'land	NSW	Vict	Tas	NT	SA	WA	Sing	Japan	Calif'
Detailed	**	***	**	*	*(*)	***	**	****	****	****
Unambiguous	**	***	**	*	*(*)	**	**	****	****	****
Measurable	**	***	**	*	**	***	**	****	****	****
Academic content	**	***	**	*	*	***	**	****	****	****

English

In relation to English, the areas chosen for analysis are approaches to beginning reading and literature (both in terms of literary genres and literary skills). The justification for this selection is that learning to read and literature are regarded as being central to English as a subject; more specifically, literacy failure in the early years is a significant factor in student failure in later years and literature is a vital element in teaching values and developing cultural sensitivity and engagement.

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

Literature	Q'land	NSW	Vict	Tas	NT	SA	WA	Calif	Eng	NZ
Detailed	***	**	**	**	**	***	**	****	***	**
Unambiguous	**	**	**	**	**	***	*	****	***	**
Measurable	**	**	**	*	**	**	*	****	**	**
Academic content	**	**	*	*	**	**	*	****	***	**

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

Early years reading	Q'land	NSW	Vict	Tas	NT	SA	WA	Calif	Eng	NZ
Detailed	**	***	**	*	**	**	**	****	***	*
Unambiguous	**	***	**	*	**	**	**	****	***	**
Measurable	**	***	**	*	**	*	**	****	***	*
Academic content	**	***	*	*	*	*	*	****	**	*

While Australian science curriculum documents have been rated highly, in comparison to overseas countries, the same cannot be said for the mathematics and English documents. Countries such as Japan, Singapore and England, and in the US, the state of California, judged by the benchmarking criteria used in this project, have intended curriculum documents that are superior to those in Australia.

As suggested later in this report, the principal reason why Australian intended curriculum documents are not as sound as those from other countries is because, since the early 1990s, Australian states and territories have adopted various versions of outcomes-based education (OBE). Stronger systems, as measured by the TIMSS results and the curriculum analysis associated with this report, in opposition to Australia, adopt a syllabus or a standards approach. The distinctions between the 3 models of curriculum development are as follows⁸:

	Syllabus	Outcomes-based education	Standards
1	detail what students should be taught/expected to learn at the start of the year	focus on what students should achieve or be able to do by the end of the process	identify what students should know and be able to do at the end of a set time
2	relate to specific year levels	address levels which incorporate a number of year levels	focus on specific year levels
3	mandated number of hours	number of hours, generally speaking, not stipulated	number of hours not stipulated
4	differentiated curriculum where students are streamed according to interests and ability	common curriculum with mixed ability teaching	common curriculum
5	based on established disciplines/categories of	multidisciplinary approach and emphasis on attitudes,	based on established disciplines/categories of

⁸ Once again, it should be noted that the following analysis relates to school education in general, both primary and secondary.

	knowledge	dispositions and feelings	knowledge
6	curriculum descriptors specific, easily understood, concise and measurable	curriculum descriptors vague, hard to measure and overly generalised	curriculum descriptors specific, easily understood, concise and measurable
7	summative assessment with high risk tests and consequences for failure, expectation that essential knowledge, understanding and skills are mastered at each year level	developmental approach to learning; focus on criteria based, formative assessment based on levels/bands that incorporate 2 to 3 year levels	expectation that essential knowledge, understanding and skills are mastered at each year level, summative assessment with some US states expecting students to repeat a year if standards not met
8	greater use of direct instruction and explicit teaching	constructivist approach to learning	greater focus on direct instruction and explicit teaching
9	emphasis on teacher directed, whole class teaching	teacher as a facilitator with a student-centred approach to teaching and learning	emphasis on teacher directed, whole class teaching

Since the national statements and profiles were developed during the early 1990s, all states and territories have adopted various versions of OBE. While the implementation of OBE in Australia led to a number of improvements, there is increasing agreement that teachers and schools have found the process difficult and frustrating⁹. The flaws in OBE include, but are not restricted to, the following:

- the fact that OBE related curriculum outcomes relate to levels incorporating 2 to 3 years, instead of being year level specific,
- the excessive number of curriculum outcomes, especially at the primary school level, that overwhelm teachers and promote a check list mentality in deciding what should be taught, assessed and reported on,
- a superficial nature of the outcome descriptors that work against the acquisition of essential knowledge, understanding and skills associated with subject disciplines,
- the difficulties involved in managing and recording individual student assessment as a result of adopting a criteria-based, continuous and diagnostic approach to assessment,
- a sense that curriculum development is occurring far removed from the realities of the classroom and unresponsive to the needs of teachers and students, and
- OBE's adoption of a constructivist, developmental approach to learning without clearly defined endpoints.

Significant is that the United States, after attempting to implement OBE curriculum at the same time as Australia, has jettisoned OBE in favour of a standards approach. It is also true that OBE has only been adopted by a handful of countries and better performing systems embrace a syllabus approach to curriculum development.

Recommendations for strengthening intended curriculum

⁹ See the Western Australian developed internet site www.platowa.com for the views of classroom teachers about the shortcomings of OBE.

Since the development of the national statements and profiles during the early to mid 1990s, Australian state and territories have adopted various versions of OBE. Currently, states and territories are going through a renewed round of curriculum development that, while acknowledging a number of weaknesses evident in OBE, still embodies many of the characteristics of this approach to curriculum development. As noted in this report (in particular, see sections 7.1, 7.2, 8, 8.1, 8.2, 8.3), OBE and associated intended curriculum documents have a number of flaws and weaknesses when compared to either a syllabus or a standards approach. It is also the case that those countries that consistently achieve the strongest results in TIMSS and TIMSS-R adopt a syllabus approach to curriculum development (see sections 5 and 6 of this report).

It is recommended that state and territories no longer adopt an OBE approach to curriculum development and, instead, adopt a syllabus model. Related to this is the need to:

- relate intended curriculum to year levels,
- reduce the emphasis on formative assessment in preference for summative assessment,
- reduce the emphasis on constructivism in preference for direct instruction and more formal teaching strategies, and
- ensure that curriculum descriptors, in the light of the results of the comparative analysis (contained in the accompanying report: *Where Do We Stand: Intended Curriculum Analysis*) are more succinct, unambiguous, measurable and based on essential learning as represented by the subject disciplines.

To assist in the above, consideration should be given to developing Australia wide syllabus documents, initially, in the areas of primary school mathematics, science and English. Such syllabuses would provide teachers with a clear and succinct road map of the essential learning required related to year levels. Such documents would acknowledge the various state and territory intended curriculum outcomes as well as international research and best practice.

A further recommendation is that state and territory intended curriculum documents are regularly benchmarked against international best practice and that the results of such research are made public. Given that this benchmarking project related to the primary level, it is also recommended that there be a benchmarking analysis of Australian state and territory secondary school intended curriculum in mathematics, science and English.

Mathematics recommendations

There is a strong argument for developing a mathematics syllabus that could be accessed by all schools in Australia. There is also an argument for a nation-wide evaluation of the performance standards linked to the syllabus using a model similar to that used in Japan where large samples of the student population are tested, not on the achievement of minimum expected standards, but on middle and higher level thinking aligned with national curriculum standards. The goal here is report on how well the curriculum is being implemented – where are students achieving well, where are students finding difficulty, which areas of the curriculum appear to be well covered and which need to be given more attention.

In countries like Japan and Singapore, syllabus documents leave no doubt about what needs to be taught at each year level, and what children are expected to understand and be able to do. Teachers are free to experiment with sequencing. But, in the main, teachers are expected

to devote their energies to improving teaching and hence the quality of student learning. This task is for all teachers in a school - from the newest teacher to the school principal. Mentoring programs are provided for young teachers. Collaborative “lesson study” programs are conducted in each primary school where all teachers work together to refine lessons and to foster high quality learning within and across subject boundaries.

Science recommendations

Australian primary science curriculum documents generally cover the same content areas that deal with the main ideas found traditionally in Chemistry, Physics, Biology and Earth and Space Science, albeit with different headings. The documents are relatively new and have attempted to reduce the large numbers of learning outcomes that prevailed several years ago. There has been an effort to ensure that teachers revisit topics and sequentially develop the science ideas within these areas. Most documents have tried to cater for both the needs and interests of students and to make the science ideas explicit and related to the students’ lived experiences of the world. The documents do not lean towards the rote learning of facts, but rather the understanding of the science principles involved and the interrelated nature of the sciences. In essence, the documents are similar, modern and based on conceptual understandings of science.

The science content, the introduction of the science content and its sequencing is remarkably similar throughout the states and territories.

There are a few weaknesses in the curriculum documents that require some consideration because the weaknesses that do prevail are significant in their potential to impact on the eventual quality related to science teaching. The Australian curriculum documents in most states and territories do not provide a year level focus, but have an outline that provides for coverage that can take up two to three years. This does not ensure that the coverage of the science content is visited regularly and consistently. The concern should be that the teaching of this science content could possibly be avoided for a year, even two years, because it is not stated that it is a required year level component of the intended curriculum.

It is rare to find a statement that either designates or suggests a recommended time allotment for teaching science in primary schools. This lack of guidance is a concern. Schools do need to be flexible and able to respond to students’ needs and interests, but against a structure of a suggested curriculum that can guide the choices and balance of the science content. It would be helpful if teachers had a guide for the time that could be anticipated for adequate coverage of the science content; teachers would then be in a better position to plan appropriate units and lessons.

The states and territories have created a large number of supportive resource materials. These support materials are available to teachers on-line to support their planning for the teaching of science and do suggest ways that science can be successfully taught in classrooms. Given the already large and detailed curriculum guidelines combined with the extensive resource materials, the danger is that teachers are overwhelmed by this detail. Teachers have the capacity to provide good teaching, yet often lack the time needed to plan, organize and implement curriculum. One of the benefits of a syllabus approach, as teachers do not have to design their own syllabuses, is that more time is given to strengthening classroom pedagogy.

Primary science has been frequently integrated into other subject areas and students are rarely

tested (Status and Quality of Teaching and Learning of Science in Australian Schools 2001). The integration of science into other areas as appropriate may strengthen or weaken the science being taught depending on the teacher's ability. Lack of testing and regular assessment in primary science may indicate a lack of clarity about the science being taught and thus to be assessed or the prevailing influence of formative assessment.

Student progress in science is often not reported to parents (Status and Quality of Teaching and Learning of Science in Australian Schools 2001¹⁰). This may reflect the lack of clarity and focus that maybe occurring in the teaching of science but contrasts with the value and expectations of parents who rate science as third in importance after literacy and numeracy in the school curriculum.

45 % of Australian primary teachers have stated that they would prefer to change careers (Status and Quality of Teaching and Learning of Science in Australian Schools 2001). Teachers are struggling to maintain a positive self-image and have high levels of stress due to lack of time, resources and professional development opportunities (Ibid). Teachers need to be valued and supported for their efforts, many primary teachers admit to experiencing difficulties and a lack of confidence with the content of science (Ibid p 172)

A strength that has been identified in the curriculum documents being used in Singapore and England is the focus and provision of the year by year sequencing guide for areas to be covered instead of levels incorporating two to three years as appears in many Australian documents. Although England provides a focus to be covered in two or three years it also details and requires certain targets to be aimed for each year.

Given the expectation in the English and the Singapore approaches that science is taught on a yearly basis, there is a greater chance that teachers address science learning on a more regular and consistent basis, when compared to the Australian approach. The provision of a time requirement for teaching science in primary schools is likely to ensure more regular coverage of the content.

The Singapore document has the ability to convey the required science content concisely, while at the same time highlighting what teachers need to focus on as essential. The curriculum has developed depth in its content, rather than breadth, and this is evident in the year by year guide that allows the teacher to stay clearly focused on their goals.

Major science recommendations

Australian Science Curriculum documents that are available to primary schools would benefit from ensuring that:

1. there is a syllabus that helps teachers to develop a yearly sequence of science curriculum learning outcomes, and
2. there is a recommended allocation of time for regular science teaching.

Supporting science recommendations¹¹

¹⁰ As a result of Australian Government legislation, it is envisaged that student progress in science will be reported as from 2006.

¹¹ The supporting recommendations, while not based on the intended curriculum analysis as such, reflect the author's view of what needs to be done to strengthen science teaching in primary schools.

Greater attention also needs to be given to:

1. support for all primary teachers to participate in science professional development programs that build science understanding, awareness of the issues in science teaching and provides time to reflect on and plan quality science teaching experiences,
2. incorporation of student designed investigations and projects that promote thinking skills and student discussion, while responding and including students' questions, needs and interests, and
3. allocation of teaching assistants who supply and maintain the science, mathematics and technology equipment in primary schools.

English recommendations

The comparative analysis of intended curriculum documents demonstrated, in the areas of literature and early years of reading, that the Australian documents are not as rigorous or sound as the Californian and the English examples. The recommendation is that an English syllabus be developed with particular attention to strengthening the areas of literature and early years of reading. In relation to literature, the recommendations are that:

- a national English syllabus be developed, based on year levels and including, but not restricted to, essential knowledge, understanding and skills related to literature as a subject,
- less emphasis be placed on critical literacy and greater emphasis on a cultural literacy model of literature,
- primary school children be given a rich and varied array of myths, fables and legends that deal with significant human emotions and predicaments,
- a study of literature, in a manner appropriate to primary school students, also include the more technical aspects of literary appreciation, including metre, rhythm and rhyme and the use of similes and metaphors associated with figurative language use, and
- consideration be given to developing sets of Australian Readers¹², similar to those developed under the Discovering Democracy program, but with a literary focus. Such Readers would provide a rich and varied selection of myths, legends and fables that would provide a common currency of morals and ethical values for Australian children to encounter.

In relation to the early years of reading, the Australian documents also fare badly when compared to the overseas intended curriculum documents. In relation to the early years of reading, the recommendations are that¹³:

- a national English syllabus be developed, based on year levels and including, but not restricted to, essential knowledge, understanding and skills related to the early years of reading,
- less emphasis be placed on the whole language approach and greater emphasis on phonics,

¹² The Australian Readers, published as part of the federally funded Discovering Democracy Program, received consistent praise from schools and teachers and, according to the Curriculum Corporation, are the most regularly re-ordered part of the programme.

¹³ The following should be considered in the light of the recommendations arising out of the National Inquiry into the Teaching of Literacy.

- resources be provided for teacher professional development, based on sound research as to the most effective way to teach literacy, and
- teacher training in the area of early years of literacy being examined to ensure prospective teachers are adequately trained.

2. Introduction

The report is the result of a project funded by DEST, and completed by Education Strategies¹⁴, to undertake a comparative analysis of intended primary school curricula in the areas of mathematics, science and English across Australian state and territory education systems as well as a selected number of overseas countries.

Reid (2005, p 11) defines the intended curriculum in the following way: “One approach is to understand curriculum as a noun. For example, many equate curriculum with a syllabus or framework. That is, curriculum is taken to mean an official document of stated curriculum intention”. While it is proper to define curriculum more broadly so as to include what actually occurs in the classroom (the implemented) and what students have learned and their level of achievement (the attained), the focus of this report is on the intended¹⁵ primary school curriculum as represented by official syllabuses and framework documents.

It should also be noted, in relation to how well students learn and levels of achievement, that the intended curriculum, while being a necessary factor in strengthening outcomes, by itself, is insufficient. Notwithstanding the importance of the intended curriculum, such factors as what happens in the classroom and the impact of wider cultural and socio/economic influences also need to be considered.

In addition to analysing primary school curriculum documents, the report also makes a number of more general comments about the relative strengths and weaknesses of different models of curriculum development. Associated with this more general curriculum discussion is an analysis identifying the characteristics of those education systems that achieve strong results in international tests and a description of how such systems define and enact the intended curriculum¹⁶.

More specifically, the project’s brief is to:

1. identify the characteristics of those education systems that perform best in international tests such as the TIMSS and TIMSS-R,
2. identify how successful education systems define and enact the intended curriculum,

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¹⁵ Researchers associated with TIMSS (Robitaille et al, 1993) differentiate between the intended curricula (represented by syllabuses and course outlines), the implemented (what is enacted in the classroom) and the attained (what students learn and levels of achievement).

¹⁶ Of value in undertaking this comparative analysis of curriculum is the work of the UK based National Foundation for Educational Research, see both the website <http://www.inca.org.uk/> and the publication *International Review of Curriculum and Assessment Frameworks* (NFER, 2004) <http://www.inca.org.uk/comparative.asp>

3. analyse the comparative strengths and weaknesses of curriculum documents in maths, science and English, and
4. evaluate the relative strengths and weaknesses of state and territory curriculum documents and suggest recommendations for improvement.

3. Benchmarking curriculum – developing a methodology

To understand educational systems and to be able to draw valid comparisons among them, information about curriculum and about instructional practices must be available along with data on student outcomes. These three factors – curriculum, instructional practices and student outcomes – are the three central points that help to explain national systems...

Robitaille, 1993, p 11

As outlined in part 4 of this report, countries associated with the OECD and APEC have undertaken, and continue to undertake, extensive research in an attempt to identify best-practice in terms of curriculum development.

If one accepts the need to undertake a comparative analysis of those education systems that perform best in international tests, then the next step is to identify what needs to be studied and to develop a methodology to achieve that end.

In relation to the first two parts of the project brief:

1. identify the characteristics of those education systems that perform best in international tests such as the TIMSS and TIMSS-R, and
2. identify how successful education systems define and enact the intended curriculum.

a desk search was undertaken to identify those publications and resources that seek to address questions such as the significance of international tests and the desire of education systems to strengthen performance. A range of research organizations, both in Australia and overseas, were identified and relevant materials analysed and incorporated in this report¹⁷.

In relation to the remaining two parts of the project brief:

3. analyse the comparative strengths and weaknesses of curriculum documents in maths, science and English, and
4. evaluate the relative strengths and weaknesses of state and territory curriculum documents and suggest recommendations for improvement.

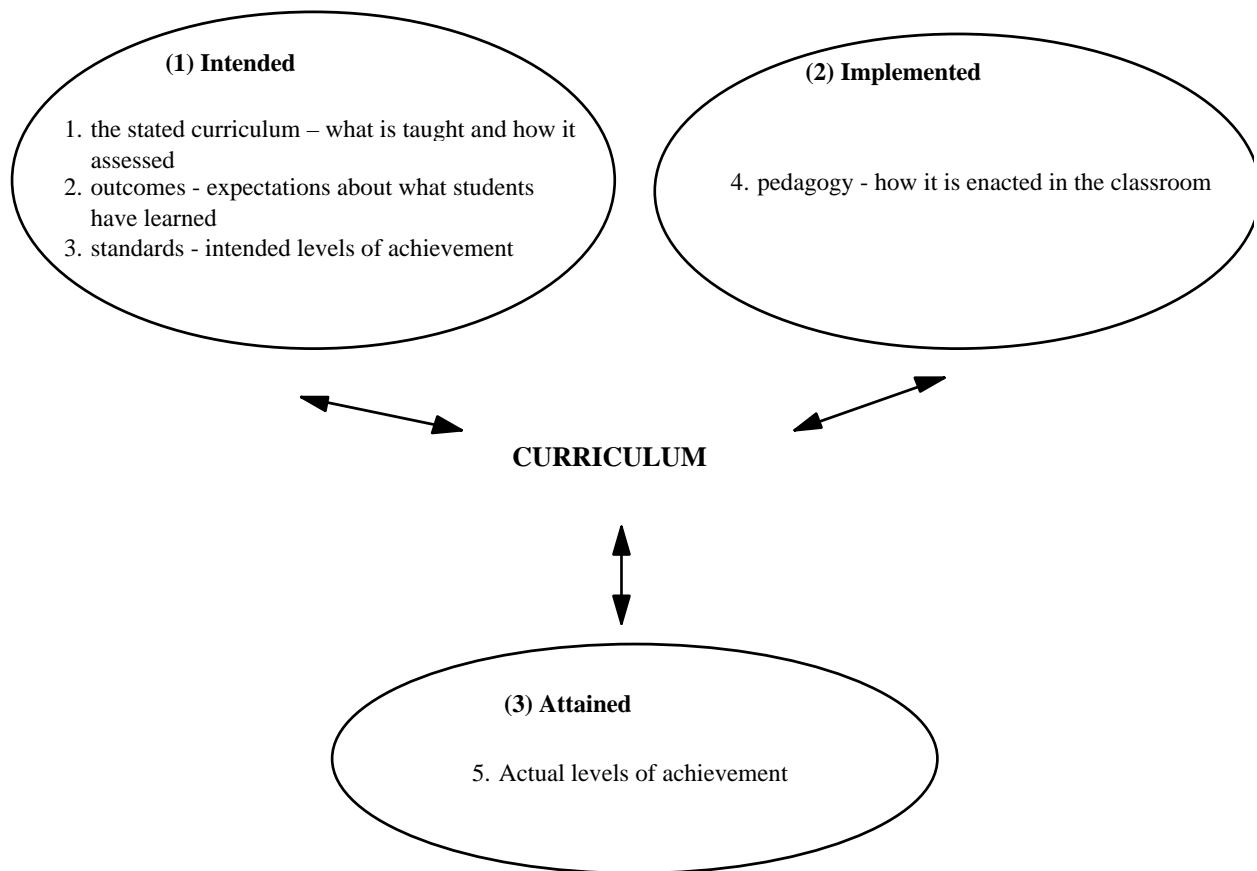
a comparative analysis was undertaken of selected primary school curriculum documents¹⁸. The methodology used to analyse and compare curriculum documents, in part, is based on the

¹⁷ See appendix B for a list of organisations and individuals identified and publications analysed to assist in the benchmarking project.

¹⁸ The results of this analysis can be found in the second report associated with this project, entitled: *Where Do We Stand: Intended Curriculum Analysis*.

research associated with TIMSS and TIMSS-R and previous benchmarking projects undertaken by Education Strategies¹⁹.

That TIMSS research describes curriculum as encompassing the intended, the implemented and the attained:



Given that the focus of this DEST commissioned report is on the intended curriculum (number 1 above), then the need is to analyse and compare Australian curriculum documents against what are considered world's best equivalent documents.

When judging what constitutes world's best equivalent documents, in relation to mathematics and science, the approach was to analyse the curricula associated with those systems that achieve the best results in international tests such as TIMSS and TIMSS-R. Since the first TIMSS test in 1994/1995 a number of countries, including Japan, the Republic of Korea, Singapore, the Netherlands, Hong Kong, have consistently achieved the strongest results. As TIMSS does not deal with English as a subject, a different approach was used to identify those systems against which the Australian English documents are compared.

As the focus of this project is on the intended primary school curriculum, significant is that the 1994/1995 TIMSS tested students at the middle primary level and at the upper grade in mathematics, Australia was outperformed by Singapore, the Republic of Korea, Japan, Hong Kong, the Netherlands and the Czech Republic. In relation to science, Australian students performed more strongly being ranked third behind the Republic of Korea and Japan. The 2002/2003 TIMSS also tested primary school students in mathematics and science and, once again, in mathematics countries such as Singapore, Hong Kong, Japan and the Netherlands

¹⁹ See Donnelly (1998, 1999, 2002)

outperformed Australian students. In science, Australia did not perform as strongly as it did in 1994/1995 and was outperformed by countries such as Singapore, Japan, Hong Kong and the Netherlands. As noted by Masters (2004) and Thomson and Fleming (2004a and 2004b), of concern is the fact that during the period between the two TIMSS tests, Australian primary students appeared to stand still, while a number of other countries were able to improve their level of student performance. Also of concern is that the results of the 2002/2003 test show that a number of countries, unlike Australia, are able to achieve stronger results for a greater majority of students and not have as great a disparity between the best and worst performing students²⁰.

It should be noted that for the purposes of this project, the Program for International Student Assessment (PISA) was not considered in identifying higher performing countries. In brief, the reasons for not including PISA in the analysis are as follows:

- the PISA test is directed at 15 year old students in secondary schools, whereas the focus of this project is primarily on the primary curriculum, and
- whereas the brief for this project relates to the intended curriculum as expressed by curriculum syllabuses and frameworks, PISA, instead of measuring specific knowledge, skills and concepts, addresses student ability to use generic skills to solve so-called real life problems. Strictly speaking, PISA does not seek to measure the intended classroom curriculum²¹.

Of relevance to this project is the fact that, such has been the general poor performance of US students in the TIMSS tests, that a good deal of resources and effort have been spent in the US seeking to strengthen that nation's school curricula by developing a criteria to rank intended curriculum documents. Three examples of establishing criteria to rank curriculum documents can be found in the work of *achieve.org*, The Thomas B. Fordham Foundation and the work of the American Federation of Teachers.

The US based organisation, *achieve.org*, established by the nation's state governors and business leaders, when evaluating intended curricula, argues that documents should be clear, specific, rigorous and teachable²². The Thomas B. Fordham Institute, in its evaluation of different school curricula, puts a similar argument when it states that successful curriculum should:

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

²⁰ In TIMSS 2002/2003 science, only 9% of year 4 students reached the advanced international benchmark compared to Singapore where approximately 25% of students reached that level (see Thomson and Fleming, 2004a, p 105).

²¹ As stated in a paper published by the UK based National Statistics organisation, in relation to PISA: "It does not provide information about the extent to which students have mastered particular school subjects... but rather aims to assess the extent to which young people can use their knowledge and skills to meet the challenges they are likely to encounter in real life" (National Statistics, 2001).

²² A more detailed explanation of what are considered strong academic standards can be found at http://www.achieve.org/achieve.nsf/StateServices_Criteria?openform

The American Federation of Teachers, in its annual ranking of the various state curricula, has also established a criteria for judging curriculum documents. In brief, the AFT's *Criteria for High-Quality Standards* (2000) argues that:

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, and
10. Standards must be written clearly enough for all stakeholders to understand.

In relation to Australia, apart from the criteria developed by the author, when reviewing the Victorian Curriculum and Standards Framework and benchmarking the New Zealand curriculum, of note is that there appears to have been little attempt to benchmark local curricula using either the above criteria or an agreed equivalent. The exceptions being work undertaken by Dianne Kerr in identifying what she describes as world-class benchmarks and a Victorian project undertaken to assist in evaluating the Curriculum and Standards Framework 11²³. The Victorian project argues that the following four elements are characteristic of world class curriculum: "equity and inclusiveness, the encouragement of innovation and creativity, clarity and focus in content specification and assessment for learning" (VCAA, 2004, p 3). In a paper presented at the year 2000 Curriculum Corporation Conference, Kerr (2000a, p 8) suggests that strong intended curricula should be:

- focused on what is agreed to be essential (rather than trying to cover everything),
- specific,
- manageable for both teachers and students in the time available,
- focused on conceptual development (rather than long lists of content),
- sequenced on the basis of evidence (rather than tradition),
- supported by shared teacher understanding of what performance 'at the expected outcome or standard' looks like, and
- assessable.

While the two definitions put forward by the VCAA publication and Dianne Kerr are of interest, as there is little explicit justification as to why world's best intended curriculum is characterised in this way, it is difficult to know on what basis their claims are made. The view that Australian curriculum developers have failed to rigorously apply any benchmarking analysis to home grown curriculum is supported by Michael Watt (2000, p 47), when he argues²⁴:

²³ Similar to this project, the task of the Victorian project included analysing "best practice in relation to pedagogy and assessment" and evaluating "the curriculum documents in terms of world's best practice" (VCAA, 2004, p V).

²⁴ Watt appears unaware of the curriculum benchmarking exercise undertaken by the author that established a methodology and a criteria to evaluate local intended curriculum, see Donnelly (1999).

However, it is more difficult to reach sound judgements about the quality of the standards expressed in curriculum documents developed by the Australian states and territories, because criteria have not been established to make valid and reliable judgements, let alone applied independently in the way such work has been conducted in the United States by the American Federation of Teachers and the Thomas. Fordham Foundation

This is unlike the criteria put forward by the US based organisations. The US criteria to evaluate world's class curriculum is based on extensive research investigating the strengths of those education systems, such as the Republic of Korea, Japan, Singapore, the Netherlands, that consistently achieve the best results in international tests such as TIMSS.

Making use of the above criteria and in response to the project's brief, a decision was made to evaluate and compare the various intended curricula documents along the lines of the following:

1. identify key curriculum descriptors, including where first introduced and subsequently dealt with,
2. identify whether the difficulty inherent in the key curriculum descriptors develops across years/levels,
3. discuss the depth of coverage of these key curriculum descriptors throughout the documents; including time allocated,
4. examine the degree of academic rigour, detail, clarity and ease of measurement of the key curriculum descriptors, and
5. note any significant discrepancies or differences of treatment between the Australian and international curriculum documents.

More specifically, in relation to the subject areas under examination, the following topics/areas of study are to be examined in the light of the preceding criteria:

- **Mathematics:** Number (Multiplication and Division; Decimals and Fractions – conceptual clarity, notation and operations); and Mathematical structure (especially as relating to arithmetical operations). The rationale for this selection is successful learning in Number is essential for all children, especially as they move from whole numbers to decimals and fractions, and from addition and subtraction to multiplication and division. Knowledge of mathematical structure comes from children's deep understanding of number in the primary school. It serves as the bridge to more formal algebraic thinking in early high school.

In addition to the various Australian state and territory curricula being examined, the primary curricula from Singapore, Japan and California will also be analysed. Singapore and Japan have consistently performed better than Australia in the TIMSS 4th grade and 8th grade tests²⁵. The California Mathematics K-6 Syllabus has been chosen because it has been ranked consistently highly in several independent studies within the US to evaluate the quality of advice provided to teachers and schools by respective State authorities. In one such study, it was ranked in first place. The California document also represents a useful case study as, since its introduction,

²⁵ On the release of the 2002/2003 TIMSS results, Geoff Masters, the CEO of the ACER observed in relation to Australia's performance: "...the relative lack of improvement in comparison to other countries was disappointing" (Masters, 2004).

along with a standards approach to curriculum implementation, there has been a steady improvement in test results in mathematics as measured by the Standardized Testing and Reporting Program (STAR)²⁶. Like Australia, responsibility for providing advice to schools in the US on what to teach rests with the States. Unlike Japan and Singapore, the US and Australia do not have a national course of study in Mathematics. Japan and Singapore consistently achieve the strongest results in international mathematics tests.

- **Science:** Physical world, in particular the areas of electricity, forces and light and sound and chemical matter, in particular properties and changes to matter. The rationale for selecting the physical world as an area of focus is because of the general disquiet concerning how physics is being taught in schools, as reflected by lack of student engagement and the low number of students studying physics, and the relative poor performance of Australian students when examined in these areas. Knowledge of chemistry is an important building block for successful studies in secondary school.

In addition to Australian state and territory curricula being examined, the primary curricula from Singapore, California and England have been analysed. Singapore and England performed better than Australia in the TIMSS 4th grade tests, with England, when compared to Australia, achieving a marked improvement in performance since the first TIMSS test carried out in 1994/1995. England's improved performance compares to that of Australian Year 4 and Year 8 students who, in the most recent 2002/2003 TIMSS test, showed very little improvement. Singapore consistently achieves the strongest results in international science tests and the California curriculum document is ranked by the Thomas B Fordham as number one in terms of standards when compared to other US documents.

- **English:** Approaches to beginning reading and literature (both in terms of literary genres and literary skills). The justification for this selection is that reading and literature are regarded as being central to English as a subject; more specifically, literacy failure in the early years is a significant factor in student failure in later years and literature is a vital element in teaching values and developing cultural sensitivity and engagement. In addition to the various Australian state and territory curricula being examined, the primary curricula from California, England and New Zealand will also be examined. California's English curriculum, according to the Thomas B. Fordham Foundation's analysis, is one of the best in the US and the rigorous public debate²⁷ in relation to standards and the need to benchmark curriculum also makes California a worthwhile case study. It should also be noted, since the introduction of a standards approach to curriculum in California, there has been a steady improvement in student proficiency in English-language Arts as measured by the Standardized Testing and Reporting Program. At the same time that Australia has been implementing OBE education and debating the strengths and weaknesses of various approaches to literacy learning, a similar debate has been occurring in England. Given the Blair Government's stated intention to raise literacy standards, the English curriculum document is worthy of analysis. Given the similarity between New

²⁶ As noted by Jack O'Connell, the State Superintendent of Public Instruction: "With five years of data, we can now see a clear trend of student gains in nearly every subject and every grade... This impressive gain in student achievement can be traced back to implementation of our comprehensive standards-based educational system (O'Connell, Jack, 2005, <http://www.cde.ca.gov/nr/ne/yr05/yr05rel86.asp>).

²⁷ Similar to Australia, much of the debate in California relates to the need to benchmark standards, especially in literacy, and to identify best practice in terms of school education.

Zealand and Australian approaches to curriculum, and the leading role New Zealand has played in implementing outcomes-based education and the whole language approach to literacy, that country is also makes for an interesting comparison.

4. International context

In searching for effective education policies that enhance individuals' social and economic prospects, provide incentives for greater efficiency in schooling and help to mobilise resources in order to meet rising demands for education, governments are paying increasing attention to international comparative policy analysis.

OECD, 2000, p 5

The majority of countries associated with the Organisation for Economic Co-operation and Development (OECD) and the Asia-Pacific Economic Cooperation forum (APEC), since the early to mid 1990s, have undergone, or are undergoing, significant reforms to their school education systems. Examples include the development of the Australian national statements and profiles²⁸ (and the various state and territory equivalent documents), New Zealand's introduction of its new senior school certificate, the National Certificate of Education Achievement (NCEA), the demise of outcomes-based education and the rise of the standards movement in the United States²⁹, the introduction of the Republic of Korea's 7th school curriculum, and reforms to education systems in Japan, Singapore³⁰ and Hong Kong to emphasise more flexible and creative approaches to learning.

In part, such activity is a result of:

- the advent of the 'digital' age associated with the knowledge economy and the changing nature of education and work,
- the increasing interdependent and competitive nature of the global economy, and
- the impact of international testing programs such as TIMSS, TIMSS-R, PISA and the desire of governments and education systems to benchmark³¹ against what are considered more successful countries.

Internationally, governments and education systems are responding to these new imperatives and challenges in a number of ways. This is evidenced by:

- establishing organizations and commissioning research to undertake a comparative analysis of different education systems³²,

²⁸ See Marsh (1994) for an historical analysis of the development of Australia's national statements and profiles, Reid (2005) also offers a more recent outline of curriculum development in Australia, including various attempts at national curriculum collaboration.

²⁹ See Shanker (1993), Manno (1994) and Marzano and Kendall (1997) for a description of US approaches to OBE and standards and what distinguishes the two models of curriculum development.

³⁰ See, for example, details about the new Singapore senior school certificate to be introduced in 2006 <http://www.moe.gov.sg/cpdd/alevel2006/experience/exp.htm>

³¹ The US based organisation *achieve.org* defines 'international Benchmarking' as: "The process of quality control whereby a set of standards is reviewed in the light of 'best-in-class' systems around the world."

³² Examples include the International Association for the Evaluation of Educational Achievement <http://www.iea.nl/>, the European based Information Network on Education in Europe <http://www.eurydice.org/>, the United Kingdom's International Review of Curriculum and Assessment

- funding research to analyse what can be learned as a result of international tests such as the TIMSS, TIMSS-R and PISA³³, and
- international conferences such as the UNESCO Year 2000 World Education Forum³⁴ and the Eighteenth Meeting of the APEC Education Forum held in Hanoi.³⁵

As noted in the quotation heading this section, common to these initiatives is the desire of governments and education systems to look globally when addressing the question of curriculum renewal and improvement. In particular, many systems are focusing on analysing how well their systems perform and how well their students achieve in relation to better performing systems; as noted by the OECD:

For policy-makers in many OECD countries, international comparisons of student achievement have become an essential tool for assessing the performance of their countries' education systems and the adequacy of their students' preparation for participation in an increasingly global world. Such comparisons offer an external point of reference for the objective evaluation of education systems' effectiveness.
OECD, 2001, p 305

For several education systems this has meant focusing on countries like the Republic of Korea, Singapore and Japan in order to identify what it is about those education systems that allows them to perform so well in international tests such as TIMSS and TIMSS-R. In the US, for example, such was that country's poor performance in international tests that the Clinton Administration initiated *Goals 2000* with the intention of establishing "a framework in which to identify world-class academic standards, to measure student progress, and to provide the support that students may need to meet the standards"³⁶. To achieve this, US researchers spent a good deal of time and effort analysing world's best curriculum and identifying the strengths and weaknesses of the US approach to curriculum development and implementation³⁷.

While, similar to this report, much of the US research focuses on the intended curricula, it is important to note that researchers in the US have also explored how the intended curriculum is implemented in the classroom. A number of video-based investigations of classrooms across of range of countries have been carried out in an attempt to explore the impact of different pedagogical approaches and to identify best practice. The rationale for such research, as suggested by Stigler and Hiebert (1999, p 2) is that: "...a major obstacle in our efforts to improve education is the dearth of information about what is happening in our nation's classrooms. Video provides us with a unique way of gathering the information we

Framework Project <http://www.inca.org.uk/> and the New Standards Project <http://www.ncrel.org/sdrs/areas/issues/methods/assment/as7nsp.htm>.

³³ Examples include Boston College's TIMSS and PIRLS International Study Centre <http://timss.bc.edu/>, Australian Council for Educational Research <http://www.acer.edu.au/research/projects.html#current> and publications such as Mathematics and Science Achievement in the Final Year of Secondary Schooling <http://timss.bc.edu/isc/publications.html>

³⁴ See http://www.unesco.org/education/efa/wef_2000/index.shtml

³⁵ See <http://www.apec.edu.tw/newssummary.htm>

³⁶ A summary of *Goals 2000* can be found at <http://www.ncrel.org/sdrs/areas/issues/envrnmnt/stw/sw0goals.htm>

³⁷ See, for example, the National Centre for Educational Statistics' publication, *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999* <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2001028>, also *A Splintered Vision: An Investigation of US Science and Mathematics Education*, Schmidt, McKnight, Raizen (1997) <http://ustimss.msu.edu/splintrd.htm>

need to examine current practices and then improve them”. Australia’s ACER is also involved in research examining classroom practice related to year 8 mathematics and science classes as part of a larger study associated with TIMSS-R³⁸.

In the UK, reports such as *Worlds Apart? A Review of International Surveys of Educational Achievement Involving England* (Reynolds and Farrell, 1996) and *England’s Education: what can be learned by comparing countries* (Smithers, 2004) also seek to identify better performing education systems and to analyse why it is that such systems achieve so well in international tests. Closer to home, a report³⁹ by the Education Review Office compares maths and science school education in New Zealand with that in the Republic of Korea, Singapore, the Netherlands and Ireland on the basis that all four have strong economies and the first three performed significantly better than New Zealand in TIMSS. When undertaking a stocktake of its Curriculum Framework the New Zealand Ministry of Education commissioned two reports⁴⁰ that sought to place the New Zealand framework within an international context.

In part, the rationale for commissioning the two reports is to evaluate the New Zealand *Curriculum Framework* within the broader context of what might be considered international best practice. In the Ministry’s words⁴¹, the purpose of the analysis was:

to provide constructive critique on the New Zealand Curriculum Framework, and the seven national curriculum statements with regards to:

- their educational integrity,
- their potential for supporting effective educational practice, and
- the standing of the New Zealand curriculum in relation to international views of effective curriculum Statements.

The focus of the report is on the curriculum as specified (the intended and regulated curriculum) rather than the curriculum as implemented.

Notwithstanding that governments and education systems are undertaking benchmarking exercises in an attempt to identify the characteristics of better performing systems, it must be admitted that the efficacy of such research is sometimes questioned. In a literature review of curricula and assessment carried out for the New Zealand Ministry of Education by staff at the University of Waikato, the authors warn against what they term “simplistic international comparisons”⁴². In a similar warning against benchmarking curricula, Joanna Le Metais argues: “there is no ‘best’ curriculum”⁴³.

On the other hand, there is a number of professional bodies and academics suggesting it is vitally important to identify those systems that achieve the best results internationally and to analyse what it is that allows such systems to perform as well as they do⁴⁴. The American

³⁸ See http://www.acer.edu.au/research/Current_projects/timss_vid.htm for an outline of the project.

³⁹ Education Review Office (2000) <http://www.ero.govt.nz/Publications/pubs2000/FuturePart1.htm>

⁴⁰ See the *Report on the New Zealand National Curriculum, 2002 – ACER*, New Zealand Ministry of Education (2002a) and the *New Zealand Stocktake: an international critique – national foundation for educational research*, New Zealand Ministry of Education (2002b)

⁴¹ Taken from New Zealand Ministry of Education (2002b), p 1

⁴² New Zealand Ministry of Education (undated), p 33.

⁴³ New Zealand Ministry of Education (2002b), p 1.

⁴⁴ See *Pursuing Excellence* reports, written in response to TIMSS and TIMSS-R, prepared by the US National Centre for Educational Statistics <http://nces.ed.gov/>, the reports by the ACER analysing Australia’s performance in TIMSS and PISA <http://www.acer.edu.au/> and Education Review Office (2000) comparative study of maths and science education.

Federation of Teachers, in its call for more rigorous and academic standards, calls on all states to: “compare their standards, assessment and results with those of high-performing countries...”⁴⁵. In a literature review funded by the US Department of Education, the point is made: “Looking at other countries may lead us to examine aspects of our own practices that might be improved” (Stevenson, Lee and Nerison-Low, 1999, p 2). In arguing the case for undertaking international comparative studies in education, Bradburn and Gilford (1990) argue a similar case when they suggest: “Since there are no absolute standards of educational achievement or performance, comparative studies are vital to policy makers in setting realistic standards and in monitoring the success of educational systems”.

As argued by the English academics David Reynolds and Shaun Farrell, when putting the case why countries such as Japan, the Republic of Korea and Singapore should be studied:

To look to other, non-English contexts and assess which of their practices might be useful here is of course a slightly risky enterprise, intellectually and practically. Factors that work within one context may not work within another, or at least may not work as productively... However, we would argue that the situation in which England finds itself is now so worrying, that the risk involved in looking outward and trying new practices is worth taking.

Reynolds and Farrell, 1996, p 59

Reynolds and Farrell also accept, when seeking to identify why some education systems perform better than others in international tests, that there is a range of interrelated factors that need to be taken into account; ranging from cultural and social influences to the rigour and effectiveness of the curriculum as enacted in the classroom. In seeking to identify why many Asian countries enjoy such success, the consensus⁴⁶ is that there is a number of more general influences that must be taken into account, these include: the influence of the Confucian tradition that leads to respect and high regard for learning, the high regard in which teachers are held and the influence of a home background that stresses the value of education and the need to for hard work and diligence in order to achieve success.

While acknowledging that there is a range of factors impacting on why some systems appear stronger than others, there is a consensus that one of the crucial factors, as common sense suggests, is the quality and rigour of the intended curriculum⁴⁷. To that extent, while the intended curriculum, by itself, does not represent a sufficient condition for educational success, it is certainly a necessary one. In addition, as noted in Lokan et al (1996, p 208), there is a strong possibility that the relatively poor performance of Australian primary mathematics and science students is related to the low expectations in relation to the difficulty of the intended curriculum. Reid (2005, p13) also highlights the importance of the intended curriculum by suggesting: “the official curriculum is a public representation of what are considered to be the purposes of education...In this sense the official curriculum is an important site in any democracy. For this reason alone it is a crucial focus for analysis”. Research also suggests that unless students receive a solid grounding in essential learning, especially during the early primary years, then they suffer educational disadvantage in later years.

⁴⁵ AFT (2003), p 11.

⁴⁶ See Reynolds and Farrell (1996), Watkins and Biggs (1996), Education Review Office (2000)

⁴⁷ See, for example, Schmidt, McKnight, Raizen (1997) *A Splintered Vision: An Investigation of US Science and Mathematics Education*, <http://ustimss.msu.edu/splintrd.htm>, Raizen et al (1999) *Facing the Consequences: Using Timss for a Closer Look at U.S. Mathematics and Science Education* and Robitaille, DF et al (1993), *Curriculum Frameworks for Mathematics and Science*.

It should also be noted that the West's preoccupation with drawing on the experience of Asian education systems is not a one-way street. In reviewing its national curriculum, one of the important steps taken by the Korea Institute of Curriculum and Evaluation (KICE) was to examine Western education systems:

In this research, the general procedures and change agents in France, the US, Australia, Japan and the UK were treated. In this comparative research, an inquiry of specific procedures for the revision of subject-area curriculum was performed.
KICE, 2003

While many Western countries are looking to the East to evaluate those countries that perform so well in international tests, at the same time, of interest is that many Asian education systems, such as Hong Kong and Japan, have looked to the West in an attempt to introduce more so-called child-centred, progressive approaches to teaching and learning⁴⁸.

5. Characteristics of education systems that perform best in TIMSS and TIMSS-R

Students in countries both with centralised curriculum setting and centralised textbook approval score statistically significantly higher in mathematics and science than students in countries without these decisions being centralised. However, the absolute size of both these effects is smaller than the effect of centralised examinations.

Woessmann, 2000, p 51

There is a tendency for countries doing well on TIMSS to have curricula that are more 'focused' (eg, Japan), that is, have fewer topics than some other countries, and for countries whose science curricula are more 'diverse' (ie cover a wider range of topics) to do less well. (Australia is somewhat in the middle of this dimension of the intended curriculum.) Textbooks play a stronger role in the science classrooms of many TIMSS countries than they do in Australia.

DEST, 2004

As a result of the desk search undertaken for this report, including an analysis of the research associated with international tests such as TIMSS and TIMSS-R, some of which is mentioned in the previous section of this report, it is possible to identify the characteristics of those education systems that consistently outperform other countries (it should be noted that the following observations relate to primary and secondary schooling). The analysis of the intended maths, science and English intended curriculum documents associated with this report also helps to identify the characteristics of better performing systems. In summary, successful education systems:

1. adopt a strong, discipline-based approach to school subjects focusing on essential learning, especially in mathematics and science. One of the flaws in Australia's adoption of OBE, especially at the primary level, is that the intended curriculum fails to give students the necessary

⁴⁸See reports such as Japan's 'Education Reform Plan for the 21st Century' <http://www.mext.go.jp/english/org/reform/07.htm>, Hong Kong's 'Learning for Life, Learning Through Life' http://www.e-c.edu.hk/eng/reform/index_e.html and Singapore's review of Junior College/Upper Secondary education <http://www.moe.gov.sg/jcreview/>

foundation knowledge, understanding and skills without which future success is impossible. The US expression, ‘a mile wide and an inch deep’, denotes a curriculum that attempts to cover too much ground and fails to introduce essential learning. As a result, not only are teachers weighed down with the responsibility of implementing hundreds of learning outcomes⁴⁹ but, when compared to syllabuses associated with more successful countries, the majority of Australia’s curriculum documents lack the necessary academic rigour and promote superficial knowledge and understanding⁵⁰. The recent movement to essential learning on behalf of some state and territory education authorities appears to be a belated recognition of such a weakness in Australia’s adoption of OBE⁵¹. The US’s rejection of OBE in favour of a standards approach, in part, is justified by the argument that OBE fails to deal with the knowledge, understanding and skills associated with the key subject disciplines.

2. provide clear, rigorous and measurable intended curriculum documents linked to text books⁵², teacher training and classroom practice. As evidenced by the analysis of the intended curriculum, see part 8 of the report, Australia’s adoption of OBE leads to curriculum descriptors that are generally vague, imprecise and lacking in academic content. When compared to more successful countries, not only do such descriptors lack academic substance and rigour, but also there are so many and they are presented in such detail, that teachers are in danger of being overwhelmed. The concern that teachers are sometimes overwhelmed is made worse by the practice of illustrating outcome statements with multiple indicators and examples that simply add to the checklist mentality and bureaucratic workload associated with implementation. One of the acknowledged strengths of a syllabus approach to curriculum development is that each school, and each teacher, does not have to re-invent the wheel by having to design his or her own syllabuses. In Japan, the Republic of Korea and Singapore more time and resources, thus, are spent on strengthening lesson preparation and classroom teaching techniques.
3. have greater time on task in the classroom, less disruption and a greater emphasis on formal, whole-class teaching⁵³. Ethnographic studies

⁴⁹ As stated in the NSW Vinson Report (2002, p 22), both secondary and primary school teachers noted that the implementation of OBE led them to: “achieve such a broad coverage of topic areas as to necessitate superficial learning”.

⁵⁰ Thomson and Fleming, 2004b (referring to Hollingsworth et al 2003) make the observation: “A video-based study of mathematics teaching in Year 8 classrooms in 1999 suggested that mathematics lessons in Australia involved a greater use of short, repetitive problems of low complexity than was evident in other countries. Lokam et al (1997, p 230) make a similar point when suggesting that Australian teachers in maths, and to a lesser extent in science, introduce more difficult topics later in the curriculum when compared to more successful countries.

⁵¹ Bruce Wilson’s 2002 paper, given at the annual Curriculum Corporation Conference, also appears to have been influential in explaining this change.

⁵² Of interest, is that a significant number of Australian Year 4 maths and science teachers admit that they do not regularly make use of textbooks (Thompson and Fleming, 2004a, and Thomson and Fleming, 2004b).

⁵³ Thomson and Fleming (2004b, p vi) note that factors such as bullying, absenteeism, lateness have a clear impact on levels of achievement.

associated with TIMSS and TIMSS-R (see Stigler, J and Hiebert, J, 1999 and Stigler et al, 1999) suggest that successful classrooms are those where there is a clear focus and expectation on what is to be achieved, teachers deal with conceptual understanding as well as developing skills, there is greater focus on teacher directed activities and there is less disruption and interruptions. Classroom strategies commonly associated with OBE, such as group work and student-centred learning, are often time consuming and ineffective and, when compared to more successful countries, Australian classrooms also face greater levels of disruption and student absenteeism. The style of teaching associated with more successful systems, by comparison, is more carefully structured and focused on teaching key content, skills and understanding. As argued by Bereiter and Kurland (1981, p 5), in comparing more structured classroom practice with more open-ended, child-centred models:

The teaching behaviour studies of Brophy & Good (1974), Rosenshine (1976), and Stallings & Kaskowitz (1974) are helpful on this point. Generally, they contrast direct with informal teaching styles, a contrast appropriate to the two kinds of models we are comparing. Consistently, it is the more direct methods, involving clear specification of objectives, clear explanations, clear corrections of wrong responses, and a great deal of “time on task”, that are associated with superior test performance. The effects tend to be strongest with disadvantaged children”.

Of interest is that an Australian research paper (Cuttance and Stokes, 2001) makes a similar point when suggesting that unstructured learning is of more benefit *after* students have been explicitly taught the requisite knowledge, understanding and skills on which such future learning is based. Dr Rhonda Farkota (2005), a researcher at the ACER, supports such a view when arguing the need for more direct instruction in Australia’s primary school mathematics classes:

It is generally accepted that a student-directed approach is more suitable when it comes to the employment and cultivation of higher order skills where reasoning and reflection are required. However, for the acquisition of basic mathematical skills, the research clearly shows that teacher-directed learning is better suited. Needless to say, these basic skills must be firmly in place before students can approach problem-solving questions with any degree of competence.

Any comprehensive comparison of the literature and research on student-directed approaches to learning, alongside teacher-directed learning, will show that the empirical data heavily favours the latter as being the more effective method yet almost every teacher-education program in Australian universities is based on a student-directed approach.

4. have regular testing and examinations used to stream students and to decide whether students should be promoted from year to year. One of the defining characteristics of OBE is the move away from summative, high risk testing and examinations to formative, criteria-based assessment. As OBE outcome statements embrace a number of year levels and are often vague and general, there is little pressure on students to succeed or consequences for failure. The failure of OBE to regularly test students against objective standards linked to key knowledge, skills and understanding also means that students often move to the next year level without mastering what is required. Stronger overseas systems generally test students at the end of primary school and use the results to stream students into different ability or interest groups with a differentiated curriculum. Research⁵⁴ related to analysing TIMSS and TIMSS-R results also concludes that better performing countries have centralised examination systems with less emphasis on school-based formative assessment:

The evidence from TIMSS-R confirms previous evidence from TIMSS that students in countries with central exit-exam systems perform better in their middle-school years both in maths and in science than students in counties without central exams. This finding holds even after controlling for a large set of variables reflecting for family background, resource endowment, and other institutional features of the school system.

Woessmann, 2002, p 5

After analysing the year 2000 PISA data, Fuchs and Woessmann (2004, p 22) make the additional point that systems and schools adopting standardised tests also appear to generate better results in maths and science. The rationale for stressing summative assessment, as noted by Bishop, is the observation that:

Learning requires the time and active engagement of students. It therefore stands in competition for students' time with other, presumably more pleasant uses. The incentives to study – rewards that increase the benefits of studying and penalties that increase the cost of failing to do so – will determine the intensity of a student's investment in learning (Bishop, 1999).

Woessmann, 2000, p21

6. How successful systems define and enact the intended curriculum

Based on the research associated with this project it is possible to identify three distinct approaches to developing the intended curriculum⁵⁵. The approach to curriculum adopted by those countries associated with TIMSS and TIMSS-R, generally speaking, can be categorised as embracing either a syllabus, an outcomes-based or, in the US, what is termed a standards

⁵⁴ See Bishop (1999), Woessmann (2000, 2002) and Jurgess et al (2003) and Fuchs and Woessmann (2004).

⁵⁵ It should be acknowledged that some curriculum documents include elements of a number of approaches. The Victorian and NSW approaches, for example, include OBE type outcome statements in addition to detailing essential knowledge, understanding and skills as would a syllabus approach.

approach. As might be expected, how the intended curriculum is defined and enacted has an impact on how successful schools are in achieving high standards for their students. Important in terms of this report is the fact that those countries that consistently perform at the highest level in international tests, such as Singapore, Japan, the Republic of Korea, Hong Kong, the Netherlands and the Czech Republic, adopt a syllabus approach to curriculum development. Unlike outcomes-based education, a syllabus approach is one where curricula relates to year levels and is expressed in terms of content to be taught, students experience summative assessment and there is often streaming based on a differentiated curriculum⁵⁶. It is also the case, as noted by Steiner-Khamsi (forthcoming, p 6), outcomes-based education is a relatively recent phenomenon, restricted to a number of English-speaking countries:

During OBE's phase of slow growth in the late 1980s and early 1990s only a few educational systems adopted the reform, notably New Zealand, Australia, England and Wales, Canada and the United States

As will be outlined in part 7 of this report, since the early 1990s, Australia has moved away from a syllabus approach to curriculum development in preference for an OBE model. It is also the case that adoption of OBE in other countries, in addition to Australia, has been less than successful. In South Africa, the consensus is that the implementation of OBE failed and it is also the case that after experimenting with OBE during the 1990s, the overwhelming majority of states in the US have switched to a standards approach. Groups such as the American Federation of Teachers are strong critics of OBE and the criteria put forward to define what is termed a standards approach has more in common with a syllabus approach than that represented by OBE. The following diagram outlines some of the important differences between these three curriculum models.

	Syllabus	Outcomes-based education	Standards
1	detail what students should be taught/expected to learn at the start of the year	focus on what students should achieve or be able to do by the end of the process	identify what students should know and be able to do at the end of a set time
2	relate to specific year levels	address levels which incorporate a number of year levels	focus on specific year levels
3	mandated number of hours	number of hours not stipulated	number of hours not stipulated
4	differentiated curriculum where students are streamed according to interests and ability	common curriculum with mixed ability teaching	common curriculum
5	based on established disciplines/categories of knowledge	multidisciplinary approach and emphasis on attitudes, dispositions and feelings	based on established disciplines/categories of knowledge
6	curriculum descriptors specific, easily understood, concise and measurable	curriculum descriptors vague, hard to measure and overly generalised	curriculum descriptors specific, easily understood, concise and measurable
	summative assessment	developmental approach to	expectation that essential

⁵⁶ For a description of how various countries construct different approaches to curriculum, see Robitaille (1997) and O'Donnell (2004).

7	with high risk tests and consequences for failure, expectation that essential knowledge, understanding and skills are mastered at each year level	learning; focus on criteria based, formative assessment based on levels/bands that incorporate 2 to 3 year levels	knowledge, understanding and skills are mastered at each year level, summative assessment with some US states expecting students to repeat a year if standards not met
8	greater use of direct instruction and explicit teaching	constructivist approach to learning	greater focus on direct instruction and explicit teaching
9	emphasis on teacher directed, whole class teaching	teacher as a facilitator with a student-centred approach to teaching and learning	emphasis on teacher directed, whole class teaching

Given that those countries that perform best in international tests have eschewed OBE in favour of a syllabus approach to curriculum and that the US has jettisoned OBE in favour of a standards approach, it is worthwhile examining a number of the above distinctions in more detail.

Firstly, Australia's first attempt at OBE, the national statements and profiles, were never intended to be syllabus documents that teachers could implement at the school and classroom level. OBE documents, instead of providing a clear and succinct road map for teachers as to what it to be taught, detail a range of outcome statements that students are expected to demonstrate at the end of a particular level or stage. Similarly, the state and territory documents associated with the current round of curriculum development have to be translated into teacher-friendly courses or syllabuses. Compared to a syllabus or standards approach, OBE places unnecessary, time consuming and onerous demands on teachers; time and effort that would be better spent developing, evaluating and strengthening classroom pedagogy.

A syllabus and a standards approach relate to specific year levels, unlike OBE where particular levels might incorporate 2 to 3 year levels. Relating curriculum to specific year levels makes it easier for teachers to develop curriculum and to monitor student progress; there is also the expectation, before students move on to the next year level, that they clearly demonstrate they have mastered the required standard of work. Having a differentiated curriculum, where students are streamed according to ability, either within a class or across different classes, allows more focused teaching that better meets the needs and abilities of students.

Secondly, the American academic Jerome Bruner in *The Process of Education* tells teachers that they must 'teach the structure of the discipline'⁵⁷. The ATF and the Thomas B Fordham criteria for ranking intended curriculum documents also emphasise the importance of the subject disciplines and the need to ensure that students are introduced to essential knowledge, understanding and skills. One of the defining characteristics of both a syllabus and a standards approach is the central importance of the disciplines and the belief that generic skills and competencies can only be taught within such a context. An OBE approach, on the other hand, by adopting a child-centred, process driven approach and by giving priority to outcomes focusing on attitudes, dispositions and competencies fails to deal with essential learning. As noted by Stone (1996, p 7), in his analysis of Dewey's influence on child-centred education of which OBE is the most recent example, essential knowledge,

⁵⁷ This quotation is taken from Crittenden (1987, p 7)

understanding and skills are secondary to the interests and needs of the individual child:

In essence, the student's 'needs' were to guide the selection and sequencing of educational experiences. Accordingly, Dewey's curriculum was comprised of the subject matter and experiences that fit the unique pursuits of the individual. Knowledge of formal subject matter was purely incidental to the educational process.

As noted in the comparative analysis of intended curriculum documents associated with this report (see part 8), Australian OBE documents, on the whole, adopt a superficial and patchy approach to detailing essential learning associated with the disciplines. That OBE documents fail to deal adequately with subject disciplines, in part, is caused by the fact that so many outcome statements are vague, difficult to measure and overly generalised.

The current round of Australian OBE documents seek to remedy this problem, in relation to particular outcome statements, by providing teachers with indicators and examples that are intended to flesh out what is required. Not only are teachers, especially in primary school, in danger of being overwhelmed by hundreds of outcome descriptors and related indicators, but also there appears little, if any, epistemological justification as to why some indicators and not others are listed or guidance as to whether some should be given precedence. If one accepts the argument associated with the philosophy of education movement, that there are distinctive forms of knowledge, traditionally associated with the subject disciplines, then what constitutes such forms of knowledge would need to be made explicit instead of being left to chance or circumstance (see Hirst and Peters, 1970, Hirst, 1974, Crittenden, 1987 and Hirsch⁵⁸, 1988 for a range of arguments in favour of this approach).

Thirdly, research associated with analysing the characteristics of those countries that out-perform Australia in TIMSS and TIMSS-R, in addition to such countries adopting a syllabus model, identify one of the qualities as a commitment to summative assessment, standardised testing and external, centrally controlled examinations. Both a syllabus and a standards approach entail regular, year level testing with consequences for failure and, in some instances, based on the expectation that students should achieve the required standard of work before they are promoted. Since the early 1990s, as a result of adopting OBE and in opposition to the more traditional approach, Australian curriculum has emphasised a developmental approach to learning, focusing on criteria-based, formative assessment based on levels that incorporate a number of year levels. As a result, children often automatically progress through school without accomplishing what is required for further successful learning. The argument that state and territory literacy and numeracy testing, generally at years 3, 5 and 7, act as a suitable substitute for normative assessment where students are ranked one against the other or against objective standards, is flawed. Not only are such tests based on minimum standards, but descriptors such as 'emerging', 'solid' and 'comprehensive' fail to adequately define the level of ability or standards met. A related difficulty is that many of the outcome statements used to define standards are so general and vague that it is impossible, with any degree of certainty, to know what constitutes success or failure.

In addition to promoting a developmental approach, an OBE curriculum also embodies a

⁵⁸ Hirsch has also been instrumental in establishing the Core Knowledge Foundation that seeks to develop curriculum based on the primacy of subject disciplines, see <http://www.coreknowledge.org/CK/index.htm>

constructivist⁵⁹ view of learning. Constructivism, drawing on the theories of Rousseau, John Dewey and Jean Piaget⁶⁰, is based on the belief that:

...students are not passive vessels for receiving knowledge but active participants who construct knowledge for themselves. This theory is said to support 'learner-centred' teaching, hands-on learning, discovery learning and the rest. Constructivism is a psychological theory about memory and learning.

Hirsch, 1996, p 133.

All of the Australian curriculum documents give precedence to constructivist approaches to learning on the assumption that learning is unique to the individual and that learning must be active and related to the real-world in the most obvious sense. Unlike a syllabus or standards approach, where there is more emphasis on direct instruction and explicit teaching, the OBE approach adopts classroom strategies like: group learning, individualised project work and enquiry learning. One of the flaws in constructivism is that it takes a common sense observation, that learning is actively constructed and that each person internalises learning in a unique way, and distorts it to such an extent that it becomes counter-productive. The types of learning associated with a more formal syllabus approach, one where students listen to a teacher standing at the front of a room, still involve active learning. Students have to listen and internalise what the teacher is saying and it is wrong to describe such a process as passive. As noted by Anderson et al (1998, p 232):

A consensus exists within cognitive psychology that people do not record experience passively, but interpret new information with the help of prior knowledge and experience.... However, denying that information is recorded passively does not imply that students must discover their knowledge by themselves, without explicit instruction, as claimed by radical constructivists. In modern cognitive theories, all acquisition of knowledge, whether by instruction or discovery, requires active interpretation by the learner... Enough consensus exists today on matters of fact to support significant educational applications. To mention one in particular, the empirical evidence refutes the radical constructivists' claim that students cannot learn by direct instruction.

In addition, a good deal of research (see Stone, 1996, Hirsch, 1997, Anderson, et al, 2000 and Sweller, 2002) suggests that more direct, formal approaches to teaching are more efficient in terms of time and effort and more successful in teaching the basics than those associated with constructivism. In particular, in the area of mathematics the consensus is that direct instruction is preferable to discovery learning⁶¹. Not only does the acquisition of deep understanding rely on mastering particular subjects, but research also suggests that rote learning and memorisation are vitally important (see Stone, 1996, Hirsch, 1997, Anderson, et al, 2000 and Sweller, 2002). One of the constant complaints of progressive educators is that those teachers who make students recite multiplication tables, historical facts or learn poetry by heart, are guilty of 'drill and kill'. The argument is that it is better to allow students creativity and flexibility and to give them the opportunity to engage in real-world projects and

⁵⁹ The South Australian SACSA Overview document states: "The framework is based on constructivist theories of learning which view the learner as active in the process of taking in information and building knowledge and understanding; in other words, of constructing their own learning."

⁶⁰ See Stone (1996) for a comprehensive and detailed account of the historical development of constructivism (or what Stone terms developmentalism) and arguments for more direct, explicit teaching methods.

⁶¹ While the focus of this discussion is on mathematics, Kerry Hempenstall (1999) argues that constructivism has also undermined effective literacy teaching in the early years of primary school.

activities. The only problem, as outlined by the American academic Hirsch, is that much of the research, especially in mathematics education, suggests the opposite. Creativity requires structure and discipline. After outlining the debates surrounding fuzzy maths and referring to the work of experts in the area of the psychology of learning mathematics, Hirsch states:

I believe you will get strong agreement from them on the following points: that varied and repeated practice leading to rapid recall and automaticity is necessary to higher-order problem-solving skills in both mathematics and the sciences. They would probably explain to you that lack of automaticity places limits on the mind's channel capacity for higher-order problem-solving skills. They would tell you that only intelligently directed and repeated practice, leading to fast, automatic recall of math facts, and facility in computation and algebraic manipulation can one lead to effective real-world problem solving. Anderson, Geary, and Siegler would provide you with reliable facts, figures, and documentation to support their position, and these data would come not just from isolated lab experiments, but also from large-scale classroom results.

Hirsch, 1997

The Australian academic, John Sweller, is also highly critical of the belief amongst progressive educators that learning somehow arises intuitively or by accident. In arguing in favour of direct instruction, as opposed to discovery learning, Sweller states:⁶²:

...information should always be presented in direct rather than indirect form... This principle applies equally to all educational contexts but flies in the face of much educational theory of the last few decades. Beginning with discovery learning in the 1960s and extending to the constructivist learning techniques of the 1980s and 1990s, enquiry based instructional techniques have gained a considerable following amongst educational theorists... In all cases, learners are required to discover information that needs to be learned rather than having the same information presented to them. There is no aspect of human cognitive architecture that suggest that enquiry-based learning should be superior to direct instructional guidance and much to suggest that it is likely to be inferior.

Sweller, 202, p 11

Significant is that in the US, one of the most expensive and time-consuming evaluations of different approaches to learning, *Project Follow Through*⁶³, reached a similar conclusion. Beginning in 1967 and concluding in 1995, after implementing and evaluating a range of different teaching strategies across some 180 school sites, ranging from direct-instruction to OBE type discovery learning, in the words of Carl Bereiter (1981, p 4) the report concluded:

The two high-scoring models according to our analysis are Direct Instruction and Behavior Analysis; the two low-scoring are EDC Open Education and Responsive Education. If there is some clear meaning to the Follow Through results, it ought to emerge from a comparison of these two pairs of models. On the one hand, distinctive characteristics of the first pair are easy to name: sponsors of both the Direct Instruction and Behavior Analysis models call their approaches "behavioral" and "structured" and both give a high priority to the three R's. EDC

⁶³A description of *Project Follow Through* can be found at http://fcis.oise.utoronto.ca/~daniel_schugurensky/assignment1/1967followthrough.html

and Responsive Education, on the other hand, are avowedly "child-centered." Although most other Follow Through models could also claim to be child-centered, these two are perhaps the most militantly so and most opposed to what Direct Instruction and Behavior Analysis stand for.

7. Australian context

The past decade in Australian education has been characterised by frenetic curriculum activity in the compulsory years of schooling. This has taken the form of major overhauls of official curricula in all States and Territories and the piloting of alternative curriculum approaches.

Reid, 2005, p 10

The type of curriculum activity occurring at the international level, as outlined in the previous section of this report, is mirrored by events in Australia over the last ten to fifteen years. As might be expected, given Australia's involvement in international tests such as TIMSS and TIMSS-R, an important part of curriculum renewal has been to undertake international comparative studies in order to understand what can be learned from overseas experience. While the scope and intensity of Australia's research are not as comprehensive as that which has occurred in the US, the UK or Europe, there are a number of examples worth noting, these include:

- conferences such as ACER's 1997 National Conference, *Raising Australian Standards in Mathematics and Science: Insights From TIMSS*⁶⁴ and the Curriculum Corporations' 2000 Conference, *World-class Curriculum*⁶⁵;
- international curriculum benchmarking studies undertaken at the state level, including Donnelly (1998), Kerr (2000a, 2000b) and the VCAA (2000); and
- publications arising out of Australia's involvement in tests such as TIMSS that analyse our performance against overseas systems, including *Maths & Science On the Line: Australian Middle Primary Students' Performance* (ACER, 1997), *Summing it up: Mathematics achievement in Australian schools in TIMSS 2002* (ACER, 2004a) and *Examining the Evidence: Science achievement in Australian schools in TIMSS 2002* (ACER, 2004b).

In addition to seeking to learn from research associated with international projects such as TIMSS and TIMSS-R, Australian curriculum developers have also spent a good deal of time, energy and resources developing new approaches to the intended curriculum. As outlined in the next section, central to this is the adoption of OBE as the preferred model of curriculum design.

7.1 Australia's adoption of Outcomes-based Education

One of the remarkable things that has happened in Australian education in recent years is the rapid achievement of a hegemony by the idea of outcomes based education. It would have been impossible to imagine, say five years ago, that by this time two things have happened:

1. that there would be a considerable degree of national consensus about the

⁶⁴ See ACER (1999) for the publication of the conference proceedings.

⁶⁵ See Curriculum Corporation (2000) for conference papers.

- purposes of education, and
2. that the consensus would be based on student learning outcomes.

Wilson, 1996, p 5

As noted in the above quotation, one of the defining characteristics of Australian education since the early 90s is the widespread influence of outcomes-based education. Of interest, while education systems across Australia promoted various versions of OBE during the 1990s, is that at the international level the strongest performing countries involved in TIMSS and TIMM-R continued to adopt a syllabus approach to curriculum development. As already noted by Steiner-Khamsi et al (forthcoming, p 6): “During OBE’s phase of slow growth in the late 1980s and early 1990s only a few educational systems adopted the reform, notably New Zealand, Australia, England, and Wales, Canada and the United States”. Also of interest, as commented on by ERIC (1993), Eltis (1995), Blyth (2002) and Lee (2003), is that Australia adopted OBE as the preferred curriculum model notwithstanding the lack of any research evidence suggesting that it had been successfully implemented elsewhere.

In the period since the Australian Education Council’s adoption of the eight key areas of learning (April 1991) and the subsequent development of the national curriculum statements and profiles⁶⁶, undertaken by the Curriculum and Assessment Committee (CURASS) on behalf of the Australian Education Council, all states and territories have implemented curriculum documents based on an OBE approach.

It is important to note that the adoption of OBE across Australia has not been uniform, since the 1993 AEC meeting in Perth, as states and territories have developed their own responses to the national statements and profiles⁶⁷. NSW, for example, as a result of an enquiry set up to review the implementation of a profiles and outcomes approach, modified its adoption of the national curriculum (see Eltis, 1995), while Tasmania, on the other hand, agreed to make use of the national statements and profiles in schools⁶⁸. It should also be noted that MCEETYA’s decision in July 2003 to develop what are termed Statements of Learning in four curriculum areas represents a further important development in Australia’s development of OBE.

In one sense, the focus on outcomes relates to the need to measure educational effectiveness in terms of student learning. Instead of measuring the success of an education system, or school, by identifying inputs, how much money is spent, how many teachers are employed or how small the classes, the intention is to measure improvements, or otherwise, in student learning. As noted by McGaw (1994, p 2), for many years, given the lack of agreement on what constituted improved learning and, if agreement could be reached, how it might be measured, it was impossible to know how well Australian students were performing. The introduction of literacy and numeracy tests at national, state and territory levels over the last 10 years or so is an illustration of the desire to measure learning outcomes.

In relation to curriculum development, the term ‘outcomes’ has a much broader meaning than just simply measuring learning outcomes in an attempt to hold schools more accountable. Outcomes-based education (OBE) represents a distinctive approach to curriculum that

⁶⁶ Boston (1992, p 30, quoted in Marsh 1994, p 27) states: “The national statements and profiles reinforce the move towards an outcomes-based education system, in common with many other developed countries”.

⁶⁷ See Watt (1998, 2000), Marsh (1994), Donnelly (2004) and Barcan (2005) for an outline of Australia’s adoption of OBE.

⁶⁸ See DTEC (1997) and Watt (1998, 2000) for an outline of how the different states and territories made use of the national statements and profiles in the years after the 1993 MCEETYA meeting in Perth.

distinguishes it from either a syllabus or, in the US, what is termed a standards approach. The US educationalist, William Spady is a staunch advocate of OBE and his works⁶⁹ have had, and continue to have, a significant impact on Australia's adoption of OBE (see Spady, 1993, Griffin, 1998, Blyth 2002 and DEET undated). Significant is that Spady differentiates between 3 types of outcomes-based education (see Spady, 1993, pp 7-11 and Willis and Kissane, 1997, pp 11-15), these include:

- traditional OBE – based on a traditional approach to curriculum, one where established disciplines have priority, there is a strong focus on content and year level organisation and the world of the classroom appears divorced from the so-called real world. The OBE focus is defined in terms of measuring students' mastery of the set curriculum,
- transitional OBE – the focus moves away from teaching subjects to cultivating what Spady terms higher order competencies, such as critical thinking, problem solving and communication skills. The focus moves from the classroom to defining what students need to be successful after graduation in terms of life-long learning, and
- transformational OBE – in opposition to conventional subjects and how schools have been traditionally structured, this approach is future oriented and focuses on what Spady terms: “the broad role performance capabilities of young people and their ability to do complex tasks in real settings, in real situations, relating more directly to life. Transformational OBE is not focused on curriculum outcomes, that is, outcomes about conventional subject areas”. Learning is no longer based on year levels and the belief that students must succeed in a set period of time.

As outlined in parts 5 and 6 of this report, a syllabus details *what is to be taught* and, at the start of the year, teachers are given a clear and concise road map outlining what the year's lessons will involve. OBE, on the other hand, identifies student-learning outcomes that are to be demonstrated or achieved *by the end of the process*⁷⁰. OBE curriculum documents are not syllabuses or work programs as such and, when compared to a syllabus approach, focus on formative, criteria-based assessment, in opposition to summative assessment and high-risk tests, and adopt a constructivist, developmental approach to education. Unlike a syllabus, where subject knowledge forms a critical part of the curriculum, it is also the case that OBE places greater emphasis on dispositions and attitudes. As noted in the 'Introduction to Essential Learnings and the SACSA Framework' (DECS, undated), when explaining the concept of OBE related essential learnings:

Essential learnings are understandings, dispositions and capabilities which are developed through the Learning Areas and form an integral part of children's and students' learning from birth to Year 12 and beyond... These understandings, capabilities and dispositions are personal and intellectual qualities, not bodies of knowledge, and they are developed throughout an individual's life.

⁶⁹ Spady has visited Australia a number of times and in 1992 conducted seminars in Canberra, Sydney, Melbourne and Brisbane.

⁷⁰ One US paper (WEAC, 1995) defines OBE as: “At its most basic level, Outcome Based Education (OBE) is where the school and community first determine what skills and knowledge students should possess at graduation, then work backwards from there to develop curriculum, strategies and materials to help students achieve those goals, or ‘exit outcomes’.” <http://www.weac.org/resource/may96/obe.htm>

At the classroom level, implementing OBE also requires a significant change in the way teachers have traditionally taught, as noted by Griffin (1998, p18):

The role of the teacher must change. The role of assessment must change. The role of the teacher needs to change from a transmitter of information to a facilitator of learning. Assessment needs to focus on progress along predetermined continua of learning and changes in the learner. Curriculum needs to maximise the students' opportunities to establish an enquiry approach to learning and to use a range of resources to lead the student along the most appropriate learning pathway to achieve the designated outcomes.

In the US, after experimenting with OBE during the 90s, the vast majority of states have moved to what is termed a standards approach to curriculum⁷¹. A standards approach, when compared to OBE, is more academic in focus, relates to specific year levels and curriculum descriptors are expected to be concise, measurable and based on academic disciplines. The following examples provided by the American Federation of Teachers illustrate the difference between standards and the weaker OBE curriculum descriptors (AFT 2000):

	Strong	Weak
English	Students should be able to develop a descriptive essay that depicts an object or event, maintains a consistent focus, uses a logical sequence, and elaborates each idea with specific details and vivid vocabulary. Grade 5	Students should be able to construct meaning through experiences with literature, cultural events and philosophical discussion. No grade level
History	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 that transformation continues to affect United States society today. Grade 9-12	Students should be able to understand, analyze and interpret historical events, conditions, trends, and issues to develop historical perspective. No grade level
Math	The student will differentiate between area and perimeter and identify whether the application of the concept or perimeter or area is appropriate for a given situation. Grade 5	Students should become mathematical problem solvers. To develop these abilities, students need the experience of working with diverse problem-solving situations. No Grade level
Science	Students should be able to describe the basic processes of photosynthesis and respiration and their importance to life. Grade 5	Students should be able to use basic science concepts to help understand various kinds of scientific information. Upper elementary

While some Australian defenders of OBE, such as Dianne Kerr, argue that when Australia

⁷¹ See Shanker (1993), Manno (1994) and Williams et al (1994) for an analysis of the US's adoption of OBE and an explanation as to why OBE was dropped in favour of a standards approach to curriculum.

adopted OBE during the 1990s we were, in fact, implementing a standards approach⁷², the evidence suggests otherwise (see Donnelly, 1999, Wilson, 2002 and Berlach, 2004) for a description of OBE and what distinguishes OBE from either a syllabus or a standards based curriculum). It should also be noted that in the US, the two quite different approaches to curriculum are also sometimes confused, in part, because “OBE is often presented to parents in a disguised form, under a variety of names, such as ‘Standards-based’ education” (Williams et al, 1994, p 1). The past President of the American Federation of Teachers, Albert Shanker (1993, p 1), also makes an important distinction between an OBE and a more academic standards approach when he argues:

OBE reformers have the rhetoric of higher standards down pat: They talk about world-class standards and the skills needed to compete in a global 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... OBE standards include academic outcomes, but they are very few and so vague that they would be satisfied by almost any level of achievement...

Following are some descriptions of OBE taken from a number of Australian sources:

Recently, curriculum documents have concentrated more on outputs rather than teacher inputs. That is, the emphasis is now on criteria-based standards that students need to attain, couched in terms of knowledge and skills. There is less emphasis on what methods a teacher might use, so long as certain, well defined outcomes are achieved.

Marsh, 1994, p 15

An outcomes approach means identifying what students should achieve and focusing on ensuring that they do achieve. It means shifting away from an emphasis on what is to be taught and how and when, to an emphasis on what is actually learnt by each student.

Curriculum Council, 1998, p 14

In the classroom, a key question for OBE is ‘What **do** the students have to do to **show** that they have learned?’ Spady (1993) argues that the central focus is on how the students had changed as a result of learning rather than on the tasks that they perform to demonstrate learning. In this context, OBE involves specifying what the students are expected to learn and then collecting the evidence that is has occurred.

Griffin, 1998, p 9

Outcomes-based education is often described as involving a fundamental philosophical shift in curriculum policy, practice and evaluation due to its unrelenting focus on what students have learned rather than on what systems and schools have provided and teachers have taught.

Willis and Kissane, 1997, p 6

⁷² Kerr (2000b, p 15) argues: “Australian educators often speak of outcomes and outcomes-based education but what they mean, and what they have always meant since the terms were first used in the early 1990s, is standards – content standards and performance standards.”

Curriculum documentation has until recently concentrated on subject matter and teaching methods. This emphasis has highlighted what **teachers do** in the learning process. The move to an outcomes approach attempts to recognise the importance of **what students know and can do**.

ACT Department of Education and Training, undated, p 18

7.2 Evaluating outcomes-based education

...the national statements and profiles have become the dominant model for curriculum specification. It seems to have been forgotten that these documents represented an unsatisfactory political and intellectual compromise... What was an unsatisfactory intellectual compromise is now viewed as a robust framework, and a model of best practice. That framework is now part of the problem.

Wilson, 2002, p 6

Given the central role OBE has played in Australian education since the early 90s, represented by the national statements and profiles and the various equivalent state and territory documents, it is worth evaluating OBE in more detail. This is especially important given the above admission by Wilson⁷³ that Australia's adoption of OBE represents an "unsatisfactory political and intellectual compromise" and the argument presented in this report, when compared to either a syllabus or a standards approach, that OBE is conceptually flawed, difficult to implement and superficial in its approach to detailing essential learning.

The first thing to note about Australia's adoption of OBE, represented by the national statements and profiles, is that a good deal of criticism was directed at the national curriculum both before and after the 1993 MEETYA meeting in Perth⁷⁴. Such criticisms included:

- lack of academic rigour and the fear that the national statements and profiles represented a fall in standards (groups such as the Australian Institute of Physics, the Royal Australian Chemical Institute and Australian Mathematical Science Council argued that the national curriculum represented a dumbed down approach to standards),
- the lack of a strong, clearly articulated educational justification for the introduction of OBE or research evidence proving the success or worth of the new approach to curriculum development (see Eltis, 1995, pp 11-22 and Blyth, 2002). In particular, there appeared little concrete evidence, either in Australia or the US, demonstrating that OBE had been successfully implemented on such a large scale, and
- a concern that the development of the national statements and profiles had adopted a 'top-down' approach to curriculum development that marginalised the interests and needs of teachers and schools (see Collins, 1994, Blyth, 2002, Vinson, 2002 and Reid, 2004).

Such were the concerns about the national statements and profiles that the MCEETYA Perth meeting decided not to endorse the documents, but to return them to the states and territories for further development and review (see DTEC, 1997 and Watt, 1998, 2000 for an outline of

⁷³ Wilson's admission about the failures of OBE is significant given his central role in developing the national statements and profiles and his defence and advocacy of OBE during much of the 90s.

⁷⁴ See Marsh (1994, chapter 7) and Donnelly (2004, chapter 3.1) for an outline of the public campaign against the national statements and profiles.

how the various states and territories responded to the outcomes of the 1993 Perth meeting). Of interest is that a NSW enquiry into adopting OBE (Eltis, 1995, p 1) raised a number of important caveats and recommended: “the Board of Studies no longer be required to incorporate the National profiles directly into the NSW syllabuses”.

The second point to note about OBE’s arrival in Australia during the early 90s is that, at the international level, it was a curriculum model that had only recently gained prominence; evidenced by the fact that it had only been adopted by a small number of countries (England, New Zealand, South Africa, Canada and the US⁷⁵). Significant, in those systems that have adopted OBE, is that there is also evidence that the experience has been less than satisfactory⁷⁶. In England, the first edition of the National Curriculum was widely criticised. In particular, teachers attacked it as unwieldy and cumbersome and, especially at the primary level, argued that it was impossible to implement in a balanced and effective way⁷⁷. In relation to the implementation of OBE in Ontario, Canada there is also evidence that teachers found the process frustrating and difficult; as noted by Hargreaves and Moore (1999, p 7):

For teachers, that is, the main problems with learning outcomes in Ontario were ones of meaning, measurement and modification. These problems aroused considerable negative emotion among teachers – emotion that can ultimately sap the energy of reform efforts.

While many states in the US, during the early 90s, also began to adopt OBE approaches, or what some termed subject area standards, the experience was such that OBE was soon jettisoned in favour of a standards approach⁷⁸. Andrew Blyth (2002, p 14) cites William Spady in this regard and concludes: “In any case, OBE as a reform movement was dead by 1995. There has been virtually no research or reference to it in the US educational literature since then”. As noted in the previous quotation from Albert Shanker (1993), OBE was criticised for advancing curriculum descriptors that were often vague, ambiguous, difficult to measure and low in academic content. In explaining the demise of OBE in the United States, Watt (2000, p 46) also suggests that part of the critique related to conservative groups attacking OBE as politically correct and focusing too much on affective matters to the detriment of worthwhile content. Such was the force of the critique against OBE that Marzano and Kendall, after outlining the origins and development of OBE in the US, conclude:

In summary, the once bright promise of subject area standards (OBE), 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 is bogged down under its own weight.

Marzano and Kendall, 1997, p 5

South Africa is another country that had introduced an outcomes-based approach to

⁷⁶ Bruce Wilson (2002, p 8) makes a similar point, when he states: ...let’s get beyond outcomes fetishism. The present form of outcomes has probably outlived its usefulness. Indeed it is difficult to find a jurisdiction outside Australasia which has persevered with the peculiar approach to outcomes which we have adopted.”

⁷⁷ See Department of Education and Training (2003, pp 20-21) for an outline of the difficulties faced with the introduction of the English national curriculum.

⁷⁸ See ERIC (1993) for an outline of a number of criticisms directed at OBE, these include: lack of any research evidence supporting OBE, the way OBE values the process of education to the detriment of essential content and the time consuming and onerous assessment practices associated with OBE.

curriculum development. Of interest, as occurred in the United States following the introduction of OBE, is that there is also opposition to what has become the new orthodoxy in designing the intended curriculum⁷⁹. South African teachers faced similar problems to their English colleagues when attempting to introduce OBE into South African schools⁸⁰. As noted by Boughey (2005, p 1):

Outcomes Based Education (or OBE) and the National Qualifications Framework (NQF) have received a lot of criticism in recent years mostly because of the problems experienced at primary and secondary levels of the South African educational system.

A South African secondary school principal, Dr Malcolm Venter (2000), in a paper presented at the Australian Principals Associations Professional Development Council (apapdc) Conference 2000, also criticises 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,
- reducing the emphasis on subject knowledge in preference to skills and process, and
- being couched in education jargon that 'disempowers' and alienates classroom teachers.

Given the flaws in OBE, it should not come as a surprise that as Australian teachers sought to implement OBE in their classrooms during the 1990s, many realised that the new approach was difficult to implement and, at times, educationally counter productive. After evaluating Australian schools' implementation of OBE, as represented by the national profiles, Griffin (1998, p 19) concluded:

Perhaps OBE cannot be fully implemented system wide. The changes needed are too radical and disruptive for whole systems of education to accommodate. Like most innovations, the ideal scenario is unlikely to be realised and the change will move through the system, leaving traces of the change in its wake.

Concerns raised by teachers included (see Eltis,1995, chapter 4, Griffin, 1998, Blyth, 2002 and Vinson, 2002, pp 89 – 94):

- the excessive number of curriculum outcomes, especially at the primary school level, that overwhelm teachers and promote a check list mentality in deciding what should be taught,

⁷⁹ See Appendix C for a summary of Jonathon Jansen's criticisms of South Africa's adoption of OBE.

⁸⁰ See Jansen and Christie (1999) for a series of papers outlining a number of criticisms of South Africa's adoption of OBE.

- a superficial and patchy nature of the outcome descriptors that work against the acquisition of essential knowledge, understanding and skills associated with the subject disciplines,
- the difficulties involved in managing and recording individual student assessment as a result of adopting a criteria-based, continuous and diagnostic approach to assessment,
- linking assessment and reporting of student outcomes to levels incorporating a number of year/grade levels⁸¹, and
- a sense that curriculum development is occurring far removed from the realities of the classroom and unresponsive to the needs of teachers and students⁸².

Thankfully, after 10 or so years of Australian schools being asked to implement OBE, a number of recent state and territory official reports, while acknowledging the positives associated with OBE, have also recognised the flaws and weaknesses in Australia's approach to developing the intended curriculum. A second, more recent report undertaken by Professor Eltis into NSW curriculum notes the heavy demands placed on teachers by OBE:

But balancing demands in a busy school day remains a critical problem. Is it possible to assist teachers to cope with the problems of the 'over-pressured school day' by making adjustments to factors which come in 'from outside' and create pressures for them? That is, is it possible to reduce external pressures and thereby liberate teachers somewhat to enable them to find time to pursue creative and innovative approaches to teaching, assessment and reporting?

Eltis, 2003, p 81

The ACT Department of Education, Youth and Family Services (2004) report, *Every Chance to Learn: Curriculum Renewal Evaluation Report*, also acknowledges the problem of teacher overload⁸³:

Because systemic curriculum came to be organised by the specified content in eight areas of study from K-12, schools and teachers struggled with the volume of content they felt they had to cover. Primary schools, in particular, felt this burden with each classroom teacher dealing with all eight Key Learning Areas when designing teaching programs.

The Western Australian report, *Investing in Government Schools: Putting Children First*, also acknowledges the pressures placed on teachers by having to implement OBE as embodied in the *Curriculum Frameworks* document:

Existing structure, strategies and operations of the central and district offices are

⁸¹ As noted by the Eltis report (1995, p 71): "The majority of teachers and parents did not favour reporting in terms of levels".

⁸² During the course of this project, a number of teachers in Western Australia became so concerned about OBE's adoption in that state that they established the internet webpage www.platowa.com. The site provides an invaluable source of practising teachers' views about the flaws inherent in OBE.

⁸³ Dianne Kerr (2000, p 12) states: "A 1999 survey of teachers in WA reveals that curriculum change is the number one reason for teachers to plan early retirement or to seek part-time employment. The situation in other states with significant programs of curriculum reform is unlikely to be different".

inadequate to the task of implementing major curriculum change through the Curriculum Framework. Many schools and teachers are experiencing significant difficulty in engaging with the requirements of an outcomes approach.

Department of Education Services, 2001, p 1

In Queensland, a new round of curriculum development is being signalled, with the recognition that previous attempts may not have been completely successful:

The framework will address concerns raised by teachers and the community about the amount of material required to be covered in the Years 1-10 curriculum, which is hindering in-depth learning.

Concerns have also been raised about a lack of clarity around what must be taught across schools and what standards of student achievement are expected...

For the first time in Queensland's P-10 years there will be rigorous, comprehensive assessment against defined standards that will be comparable across schools.

Department of Education and the Arts, 2005a, p 2

Finally, in Victoria, where a new round of curriculum development is being undertaken, under the title, Victorian Essential Learning Standards⁸⁴, there is the observation:

In summary, it can be argued that the current ways in which many curriculum authorities have conceived the curriculum for schools has resulted in poor definitions of expected and essential learning and provides teachers with insufficient guidance about what to teach. It has been suggested that 'as our current documents stand, teachers could find a basis for teaching everything they know' as 'there are few priorities set, effectively little essential learning identified and few discriminations made about which bits matter for young Australians to learn' (quote taken from Bruce Wilson).

VCAA, 2004, p 12

While it is significant that the above extracts represent official recognition of a number of flaws in Australia's adoption of OBE, it is also important to take note of the change in terminology being used to describe curriculum. On the level of rhetoric, at least, there is recognition that more is needed to develop 'deep understanding', 'rigorous standards' and to promote 'essential learning'.

7.3 Curriculum in transition

Based on the research associated with this project, it is obvious that states and territories are experiencing a new round of curriculum development. In part, the impetus for this curriculum renewal is the recognition that Australia's adoption of OBE over the last 10 or so years has been less than perfect. While it is too early to judge whether the current round of curriculum development will prove any more successful than that which occurred during the

⁸⁴ The intended curriculum analysis related to Victorian curriculum has utilised the VELS documents and not those related to CSF11.

1990s it is possible, as a result of the research associated with this project, to make a number of observations.

William Spady (1993) differentiates between 3 different types of OBE curriculum models: traditional, transitional and transformational. Australia’s national statements and profiles and the various state and territory equivalent documents developed during the 1990s adopted a traditional OBE approach. While the focus of learning shifted to students demonstrating outcomes and outcome levels related to 2 or 3 year levels, there was still a focus on traditional subjects and the content and structure of the curriculum centred on the classroom; as opposed to what Spady terms “real life demands and living experiences”. In opposition to traditional OBE, Spady’s preference is for what he terms transformational OBE, Spady describes this as:

Transformational OBE is future-oriented. It exists to equip all students with the knowledge, competence and orientations needed for them to successfully meet the challenges and opportunities they will face in their career and family lives after graduating. It focuses on students’ life-long adaptive capacities. It is focused more on the broad role performance capabilities of young people and their ability to do complex tasks in real settings, in real situations, relating more directly to life. Transformational OBE is not focused on curriculum outcomes, that is, outcomes about conventional subject areas. Transformational OBE is concerned solely with students’ success after they leave school.

Spady, 1993, p 10

An analysis of the intended curriculum documents associated with the current round of development across Australian states and territories shows that the majority of states and territories are embracing transformational OBE in preference to traditional OBE. The following grid summarises state and territory models of curriculum development:

State/territory	Model of curriculum development
Queensland	As with the other states and territories, Queensland also places what are termed ‘essential learnings’ at the centre of the curriculum. Similar to Victoria, these essential learnings are divided into 3 areas: the content normally associated with the key learning areas, the skills and attributes associated with “real-life challenges, such as higher-order thinking skills...” and the knowledge and skills “needed for good communication and ongoing learning”.
New South Wales	NSW, in part, as a result of two reports Eltis (1995) and Eltis (2003), is one state that appears to be resisting the move from traditional OBE to transformational OBE. Unlike the majority of the other states and territories, NSW does not define the curriculum in terms of broad competencies, dispositions and attitudes, preferring to ground the curriculum in the key learning areas which are described as syllabuses.

ACT	The ACT approach begins with the statement that: “The purpose of curriculum is to develop each student as a learner, as a person, as a community member and as a contributor to society”. Phrases like “lifelong learning”, “education of the whole person”, “problem solvers and innovators” and students applying their knowledge “to experiences beyond school” are highly suggestive of a transformational OBE approach. The 10 principles underpinning the curriculum and the 36 essential learning achievements can also be characterised as adopting Spady’s preferred approach. Statements like “every student can learn” and “Curriculum should provide every student with sustained opportunities to learn” reflect Spady’s belief that all students are capable of success. Finally, the 36 essential learning achievements are expressed as broad, generic outcomes that give priority to attitudes and dispositions as opposed to academic content.
Victoria	The Victorian approach to curriculum also employs the word ‘essential’, but unlike the ACT and Tasmania documents there is a greater recognition of the importance of the academic disciplines. The Victorian Essential Learning Standards involve 3 interrelated areas: physical, personal and social learning, discipline-based learning and interdisciplinary learning.
Tasmania	In opposition to a traditional approach, where curriculum is defined in terms of subject disciplines, the Tasmanian <i>Essential Learnings</i> curriculum adopts the transformational OBE model. Curriculum is constructed in terms of 5 organisers: thinking, communicating, personal futures, social responsibility and world futures. These overarching organisers are further defined in terms of culminating outcomes and key element outcomes that are expressed in terms of broad, generic outcome statements. As noted in this project’s analysis of the Tasmanian intended curriculum, many of the outcome descriptors are vague and lack academic rigour.
Northern Territory	Similar to Spady’s transformational OBE approach, the NT Curriculum Framework stresses the goal of education as developing students who are “Connected Life-Long Learner(s)” with an emphasis on developmental learning and “EsseNTial Learnings” (these are defined as: the inner, the creative, the collaborative and the constructive learner). While acknowledging the importance of the content associated with Learning Areas, the NT approach describes itself as embracing an outcomes-focused approach based on levels that incorporate a range of year levels and a developmental, formative approach to assessment.
South Australia	While acknowledging the relevance of the 8 learning areas, the South Australian curriculum also emphasises what are termed essential learnings, these include: futures, identity, interdependence, thinking and communication. Similar to Spady’s approach, the emphasis is on “understandings, dispositions and capabilities” and the world outside the classroom is given priority, on the basis that: “These understandings, capabilities and dispositions are personal and intellectual qualities, not bodies of knowledge, and they are developed throughout an individual’s life”. The SACSA Framework is based on “constructivist theories of learning” and adopts a student-centred view of education.

Western Australia	The Western Australian <i>Curriculum Framework</i> document, while dealing with key learning areas, places the KLAs within the context of: present and future conditions, values, overarching statement and key features of the curriculum framework. The 7 key principles and the 13 overarching learning outcomes resonate with Spady's description of transformational OBE, as does the fact that many of the curriculum descriptors used to detail the KLAs focus on attitudes and dispositions to the detriment of rigorous academic content.
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On the basis of the above, it is possible to generalise and to say that the majority of states and territories, excluding NSW, Victoria and Queensland, are moving from a traditional OBE to a transformational OBE approach. It is also the case that all states and territories have continued to adopt significant characteristics of OBE education, including:

- relating learning outcomes to levels that incorporate a number of year levels instead of being year level specific,
- emphasising formative, criteria-based assessment to the detriment of summative, high-risk assessment with clear consequences for failure,
- favouring a constructivist and developmental approach to learning, and employing curriculum descriptors, in terms of the criteria established to evaluate intended curriculum documents, that continue to be vague, overly generalised and lacking in academic content and rigour.

8. Benchmark selected intended curriculum documents

In relation to the project description, two essential requirements are to:

1. analyse the comparative strengths and weaknesses of curriculum documents in maths, science and English; and
2. evaluate the relative strengths and weaknesses of state and territory curriculum documents and suggest recommendations for improvement.

The following section of the report includes a detailed description and analysis of selected intended primary curriculum documents in mathematics, science and English; in particular, the intended curriculum has been evaluated in order to:

1. identify key curriculum descriptors, including where first introduced and subsequently dealt with;
2. identify whether the difficulty inherent in the key curriculum descriptors develops across years/levels;
3. discuss the depth of coverage of these key curriculum descriptors throughout the documents; including time allocated; and
4. examine the degree of academic rigour, detail, clarity and ease of measurement of the key curriculum descriptors and
5. note any significant discrepancies or differences of treatment between the Australian and international curriculum documents.

Note: the following is a summary of the analysis undertaken; a copy of the full analysis of the intended curriculum documents is contained in the report accompanying this document entitled: *Where Do We Stand? Intended Curriculum Analysis*. The ACT has not been included in this analysis as the territory, while agreeing on broad essential learning

achievements, has not published any intended curriculum documents as such. As has already been noted, the approach in the ACT, evident in *Every Chance to Learn Curriculum for ACT Schools P-10 Principles and Framework Phase 1 2005*, bears close resemblance to a transformational OBE model of curriculum development.

8.1 Benchmarking mathematics

	Q'land	NSW	Vict	Tas	NT	SA	WA	Calif	Sing	Japan

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

	Q'land	NSW	Vict	Tas	NT	SA	WA	Sing	Japan	Calif
Multiplication and division										
Detailed	**	**	**	*	*(*)	****	**	****	****	****
Unambiguous	**	**	**	*	*(*)	***	**	****	****	****
Measurable	**	**	**	*	**	***	**	****	****	****
Academic content	**	**	***	*	*	****	**	****	****	****

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

	Q'land	NSW	Vict	Tas	NT	SA	WA	Sing	Japan	Calif'
Fractions and decimals										
Detailed	**	***	**	*	*(*)	***	**	****	****	****
Unambiguous	**	***	**	*	*(*)	**	**	****	****	****
Measurable	**	***	**	*	**	***	**	****	****	****
Academic content	**	***	**	*	*	***	**	****	****	****

There is wide variability in the quality of the primary curriculum documents (syllabuses, content standards etc.) provided by the Australian States and Territories to guide teaching and to assist schools to plan programs in Mathematics.

Compared to equivalent documents used by Singapore, California and Japan, the Australian documents, almost without exception, fail to provide clear guidance for teachers about what to teach at each Year Level, preferring as a rule to specify content standards across two-year intervals.

Some Australian documents are poor, by any standard, in that they leave too many gaps for teachers and schools to “fill in” when planning teaching and designing a school program. Many are deficient in mathematical accuracy and clarity. This is especially difficult for primary schools where many teachers do not have a strong mathematical background and where many schools do not use a textbook, and therefore need to, and should be able to, rely on official documents to plan for teaching and assessment.

Some school systems, it is true, do provide sample programs; and while these may suggest a possible sequence of instruction, they generally do not deal with key points of mathematical focus for teaching, or provide accurate definitions of mathematical concepts, or give

unequivocal advice about what children should understand, know and be able to do. Teachers and schools are right to expect that these matters will be dealt with by official curriculum documents. Compared to the overseas documents used in this analysis, most Australian States and Territories fall short of this expectation.

In general, the Australian documents, unlike their overseas counterparts used in the benchmarking exercise, leave teachers and schools guessing what key terms mean. They are often wordy and long at the expense of mathematical clarity and precision. By contrast, the primary school component of the Mathematics Program in Japan is written in fewer than 15 pages. Singapore's Primary Mathematics Syllabus is written in 50 pages. Moreover, both documents, unlike most of their Australian counterparts, provide advice on what to teach by Grade or Year level. Mathematical content is specified clearly and succinctly, leaving teachers free to plan how best to teach rather than having to decide what to teach.

In addition to these overseas documents, the various Australian school authorities would do well to examine the recently released (draft) *Syllabus K-8 Mathematics* prepared by the Mathematics Achievement Partnership (MAP, USA, 2004) which is a model of clarity and precision in only 89 pages⁸⁵, providing clear mathematical definitions and detailed discussion of essential content for nine year levels.

By and large, the principal shortcoming of the Australian documents is their failure to specify clearly and in sufficient detail what is important to teach and what students are expected to understand, know and be able to do⁸⁶. It remains to be asked whether this wide variability of quality in the Australian documents can be remedied by leaving the task to each State and Territory.

Elaborations

With reference to some of the content areas used in this benchmarking study – fractions, decimals, multiplication and division⁸⁷ – the following are glaring weaknesses and omissions in the Australian documents with very few exceptions.

Fractions:

The Australian documents all place too much reliance on an intuitive idea of a fraction as a part of a whole (sometimes called a *pizza* model) without supporting this idea with a clear mathematical definition that includes the fundamental idea of a fraction as a number.

Almost all Australian documents rely on an *area* model to introduce fractions. Unlike the Japanese documents, for example, they fail to use length to define and illustrate fractions (fractional numbers) where a fractional number, such as $1/3$, can be defined either a point that lies one-third of the way from 0 to 1 on the number line, or as the length of the interval between 0 and this point.

⁸⁵ One of the criticisms of Australia's adoption of OBE is that intended curriculum documents are too lengthy and contain too many outcomes statements and illustrations. The benefit of more succinct and concise curriculum documents is that teachers are not overwhelmed by the detail and essential learning is clearly signalled.

⁸⁶ A more detailed analysis of Australian state and territory mathematics documents can be found in the accompanying report, entitled: *Where Do We Stand? Intended Curriculum Analysis*.

⁸⁷ See page 17 of this report for the rationale for choosing these topics for analysis.

The “intuitive” area model, on which almost all the Australian documents rely, is especially weak in helping teachers and students to understand that a fraction can be interpreted in three ways: as

- a point on the number line, as a number that lies between two consecutive (whole) numbers,
- the length of a segment of the real number line, and
- a part of whole.

When used alone, a fraction such as $1/3$, is a number or length, but when used in contexts such as “a third of an apple”, the fraction represents a part of whole.

The Australian documents frequently refer to “unit fractions” (e.g. $1/2$, $1/3$, $1/4$ etc) without reference to their mathematical properties. They assume that teachers and students will understand what a unit fraction is by *how it is written*, i.e. they all look like $1/n$. Missing are explicit definitions of a unit fraction in terms of the number of equal parts in which the unit interval (a length) is divided. Also missing is the mathematically fundamental idea that each unit fraction (e.g. $1/4$) generates other fractions of the form $2/4$, $3/4$, $4/4$, $5/4$, ..., and how the fractions, so generated, are located on the number line.

Across the Australian documents, there is a scant treatment of mixed numbers (e.g. $1\ 3/4$) as an alternative notation for fractions greater than 1. For instance, only two State documents make reference to mixed numbers as improper fractions. Several Australian documents do not mention mixed numbers at all.

Multiplication

All Australian documents require students, usually by Year 4 or 5, to know the multiplication tables up to 10×10 . In passing, it should be noted that children in Japan and Singapore are expected to know these multiplication facts about one year earlier. But a more glaring omission from the Australian documents is their failure to explain to teachers what it means to know multiplication facts to 10×10 . It is far more than knowing “a song” or being able to recite tables.

Knowing the multiplication tables up to 10×10 means being able to find quickly missing numbers in multiplication and division statements, such as $7 \times [] = 56$, $56 \div 8 = []$, $12 \div [] = 3$.

Knowing by instant recall is clearly the goal, but recalling patterns that enable a correct rapid response needs to be emphasised as an important stage in achieving this goal. For example, when asked $7 \times [] = 56$, a student in Year 4 might respond quite commendably as follows, “I know $7 \times 7 = 49$, 56 is 7 more than 49, so $7 \times 8 = 56$.” Teachers need to see the importance of using these patterns as means of achieving knowledge and easy recall of tables facts.

Most Australian documents include the requirement to be able to multiply a multi-digit number by a single-digit number, for example 35×3 . What is missing is the requirement made explicit in the overseas documents that children, by Year 4 or 5, should be able *to understand and use a reliable algorithm* for multiplying a multi-digit number by a single-digit number; *and explain* why the algorithm works. Fundamental to any explanation is the distributive property applied to place value: $35 \times 3 = 3 \times 35 = 3 \times (30 + 5) = 3 \times 30 + 3 \times 5 = 90 + 15 = 105$.

Decimals

Decimals in the Australian documents are generally not linked clearly to fractions and place value, as they are, for example in the Singapore syllabus. There, it is clear that initially students should understand decimal digits in the context of place value for terminating decimals up to two decimal places. The Singapore Syllabus is clear that a terminating decimal is a place value notation for a special class of fractions with powers of ten for their denominators. The Singapore document also requires students to understand the value of the digits in a decimal and to express these in alternative notations: e.g.

$$\begin{aligned}0.59 &= 5/10 + 9/100 \text{ or } 59/100, \text{ and} \\1.59 &= 1 + 5/10 + 9/100 = 1 \frac{59}{100} \text{ or } 159/100, \text{ or} \\1.59 &= 100/100 + 59/100\end{aligned}$$

By contrast, the Australian documents at their best discuss “place value from hundredths to tens of thousands”. One Australian document links decimals to cents and centimetres, failing to make the necessary link to place value in introducing decimals.

Analysis of intended mathematics curriculum documents

Queensland

The principal document used for this analysis was the Mathematics Years 1 to 10 Syllabus published by the Queensland Studies Authority (2004). (web address www.qsa.qld.edu.au)

The document presents core learning outcomes organised according to Standards, where it is stated “For the purposes of planning learning and assessment, outcome levels typically relate to year levels as follows:

students demonstrating Level 2 outcomes are at the end of Year 3
students demonstrating Level 3 outcomes are at the end of Year 5
students demonstrating Level 4 outcomes are at the end of Year 7 ...” (p.16).

Some other learning outcomes are described as “discretionary”. These have not been considered in this analysis.

Tables of core learning outcomes are presented (pp. 18-36). Within the Number Strand, there are separate statements of core learning outcomes for Number concepts, Addition and subtraction, and Multiplication and division. Statements referring to Fractions and Decimals are embedded in an overall Level statement and in consequential statements relating to core learning outcomes for Number concepts, Addition and subtraction, and Multiplication and division.

There is a separate Strand entitled Patterns and Algebra; and within this strand there are core learning outcomes under the heading of Equivalence and equations. Core content is specified in a subsequent section (pp. 38-66) which is intended to show how core learning outcomes can be used “to plan for planning learning and assessing”. (Excerpts from this section have been incorporated in the report using the smaller 10 point font.) Core content in Number is presented under the same headings used for core learning outcomes; namely, Number concepts, Addition and subtraction, and Multiplication and division. Core content in Patterns and Algebra follows the same patterns using the heading Equivalence and equations.

In making comparisons with other States, it should be noted that Queensland’s Level 2 (by the end of Year 3) overlaps partially with NSW Stage 2 (by the end of Year 4) and SA Standard 2 (by the end of Year 4); and that Qld Level 3 (by the end of Year 5) overlaps partially with NSW Stage 3 (by the end of Year 6) and SA Standard 3 (by the end of Year 6).

The Queensland document is the only Australian document to make recommendations concerning time estimated “to provide students with opportunities to demonstrate the core learning outcomes in the Mathematics key learning area and are as follows:

Years 1 to 3: 600 hours across the three years

Years 4 to 7: 640 hours across the four years

Years 8 to 10: 240 hours across the three years (p. 16)”.

Overall Ranking: Queensland

Detailed **(*)

Unambiguous **

Measurable **(*)

Academic Content ***

Comment: The Queensland document is generally a strong document. It complements outcome statements with elaborations of core content. These are helpful, but tend to lack the degree of specificity achieved, for example, by South Australia and the overseas documents. They also tend not to show progression in content as clearly as these other documents.

Victoria

The principal document used for Victoria was the Victorian essential Learning Standards (VELS) Discipline –based Learning Strand: Mathematics published by the Victorian Curriculum and Assessment Authority in 2005. (web address www.vcaa.vic.edu.au)

The Standards are set out according to Levels which were established in the previous document Curriculum and Standards Framework II also published by VCAA where Level 1 describes core content that most students will be expected to achieve by the end of the Preparatory Year. Thereafter, each Level corresponds to two years of schooling: Level 2 by the end of Year 2; Level 3 by the end of Year 4; and level 4 by the end of Year 6.

It should be noted therefore that VELS Level 4 needs to be compared to SA Standard 3 and to NSW Stage 3.

Core content being considered in this report is described under the Number dimension in which are embedded descriptions for multiplication and division, and fractions and decimals. Standards for Structure are introduced from Level 3; and here core content relating to pattern and algebra is described. Further documentation may be anticipated to elaborate these Standards.

Overall Ranking: Victoria

Detailed **

Unambiguous **

Measurable **

Academic Content ***

Comment: The VELS document succeeds the former Curriculum and Standards Framework

II, and may require some detailed elaborations to convey fully to teachers its intentions. The introduction of a new section on (Mathematical) Structure is to be commended. This is a distinct section from Working Mathematically. Victorian documentation is in transition.

Singapore

The principal document used for this report was the Primary Mathematics Syllabus published by the Curriculum planning and Development division of the Ministry of Education, Singapore, in 2001.

(web address: www.moe.gov.sg/cpdd/doc/Maths_Pri.pdf)

The syllabus is intended to guide teachers to plan their Mathematics programmes. While it is said that teachers need not be bound by the sequence of topics, they do need to ensure that the hierarchy and linkage are maintained. The Syllabus elaborates detailed descriptions of content relatively briefly (pp. 15-50). This is done by Year level starting from Primary 1. From Primary 1, within the area of Whole Numbers, there are separate sections for Multiplication and Division. Each section comes with its own outcomes. From Primary 2, the topic of Fractions is introduced with outcomes stated briefly. Decimals are introduced from Primary 4 with six sections each containing outcomes: Number notation and Place value, Addition and subtraction, Multiplication and division, Conversion between decimals and fractions, Approximation and estimation, and Word problems. (This is an interesting comparison with California where decimals are introduced a little earlier in the primary curriculum. The Singapore treatment is later and more intensive.)

In Primary 5, further outcomes are specified for Number. But in Primary 6, there are no additional outcomes. Presumably this year is to be used for consolidation. There is no separate strand for Algebra in the Singapore Syllabus.

Overall Ranking: Singapore

Detailed *****

Unambiguous *****

Measurable *****

Academic Content *****

Comment: Singapore has long been one of the world leaders in mathematics achievement in TIMSS and other tests. High expectations, government approved textbooks, highly focussed teacher training and professional development all work together to support success. The Syllabus document is an exemplar of clarity and careful development of academic content. It is recognised that classes in Singapore primary schools tend to be streamed in the final years. The expectations of student performance presented in this document may be somewhat higher than in Australian schools.

Japan

The principal document used for this report was the Mathematics Program in Japan - Elementary, Lower Secondary & Upper Secondary Schools translated into English from the national Course of Study in Mathematics published by the Ministry of Education, Science, Sports and Culture by the Japan Society of Mathematical Education (JSME), August 2000. This document is not available in electronic form.

National standards for education are prescribed in the Courses of Study compiled by the

Ministry of Education. The Ministry also provides curriculum guides in which objectives and contents are explained in detail, and compiles instructional materials in which teaching methods are explained. The board of education in each prefecture produces curricula based on the Courses of Study. These are followed by public schools. National and private schools make their own curricula based on the Courses of Study.

Textbooks produced by commercial publishers must be approved by the Ministry based on the Courses of Study. Time allocation for mathematics in elementary and lower secondary schools is specified in the national course of study. Revised time allocations, to take account for example of the abolition of Saturday schooling, took effect in 2002 for elementary schools. They require 114 periods (each 45 mins) spread over 34 weeks in the first year of elementary school, with 155 periods spread over 35 weeks for the second year, and continuing with 150 periods per year for the remaining years (Grades 3 to 6). The recommended time allocation for these grades is therefore slightly less than 200 minutes per week of *actual* in-school time.

The Course of Study in Mathematics elaborates detailed descriptions of content relatively briefly (pp. 7-20). This is done by Year level starting from Grade 1. At each year level, there is a short statement of Objectives followed by Contents. The topics considered in this study all fall with under the content heading Numbers and Calculations. Multiplication is introduced from Grade 2; Division from Grade 3; and Fractions and decimals from Grade 4. It is important to note that multiplication is introduced first, and that by Grade 5 Multiplication and Division are treated together. In Grade 5, Multiplication and Division are extended from integers to include multiplication and division of decimals; and in Grade 6 they are extended further to include to include multiplication and division of fractions, making explicit links to earlier work on multiplication of integers and decimals.

There is no separate strand for Algebra in the Japan course of study although algebraic expressions (in the form of missing number expressions – such as $7 \times [] = 56$, $56 \div 8 = []$, $12 \div [] = 3$ – to represent multiplication and division) are introduced from Grade 2.

Overall Ranking: Japan

Detailed ****

Unambiguous ****

Measurable ****

Academic Content ****

Comment: Like Singapore, Japan has long been one of the high achievers in mathematics achievement in TIMSS and other tests. High expectations, government approved textbooks, sustained “lesson study” by all teachers at local school and district level work together to support success. The Syllabus document is a model of concise and clear expectations about what children are expected to understand, to know and to be able to do. Very careful interlinking of content is evident in the treatment of topics. Teachers know what links are to be made and where. They also know when different elements are to be given greater attention and depth in relation to other topics.

California

The principal document used for this report is: Mathematics Content Standards produced by the State Board of Education in 2002 (web address www.cde.ca.gov/ci/cr/cf/index.asp)

The document elaborates content standards for each year level. Within the strand entitled Number Sense, there are separate standards for Multiplication and division, and for Fractions and decimals. For each year level, there is a distinct strand entitled Algebra and Functions. Each standard is introduced by a generic statement (italics have been used to designate these sentences) which is then followed by several specific statements which elaborate the standard. Only one or two of these elaborations have been included in this report.

Overall Ranking: California

Detailed ****
Unambiguous ****
Measurable ***(*)
Academic Content ****

Comment: this is very well crafted and ambitious document. In the evaluation of State MATH Standards carried out by the Fordham Foundation (www.edexcellence.net) the California State Maths Standards were rated as the best in the USA across a wide range of criteria. It has been said that the California Standards represents a goal of where this state would like to be in ten years time. Its mathematical rigour will challenge many primary teachers.

New South Wales

The principal document used was the Mathematics K-6 Syllabus published by the NSW Board of Studies in 2002.

(web address: www.boardofstudies.nsw.edu.au)

The Mathematics K-6 Syllabus presents outcome statements in a relatively short section (pp. 13-23) according to Stages. The goal is that by the end of Year 6 most students will have achieved Stage 3. Early Stage 1 covers content that most students can be expected to have learned prior to school. Stage 1 covers outcomes that most students might be expected to learn by the end of Year 2; Stage 2 by the end of Year 4; and Stage 3 by the end of Year 6. It is also expected that some students will have achieved far more than Stage 3 by the end of Year 6, and for this reason Stage 4 outcomes have also been included.

Within the Number section, there are clear and separate statements of outcomes relating to Multiplication and Division, Fractions and Decimals. There is a separate section entitled Pattern and algebra.

Within Mathematics K-6 Syllabus, there is an extensive section entitled “K-10 Mathematics Scope and Continuum” (pp. 27-157) which is intended to provide “an overview of the sequence of learning for particular concepts in mathematics and links content typically taught in primary mathematics classrooms with content that is typically taught in secondary mathematics classrooms. It illustrates assumptions about prior learning and indicates pathways for future learning” (p. 27).

Overall Ranking: New South Wales

Detailed **(*)
Unambiguous ***

Measurable ***

Academic Content ***

Comment: The New South Wales Syllabus document complements its Stages of achievement with a clear specification of content through its use of a Content continuum. This section shows how content progresses in complexity. This is demonstrated clearly in the treatment of Multiplication and division; even more so in Fractions and decimals, but perhaps not so clearly in the case of Algebra. Progression from each year level to the next is not shown as clearly as in the South Australian document. This is to be expected when relying on Stages to represent two years of schooling.

South Australia

The principal document used for this analysis was the South Australian Curriculum and Standards Authority R-7 Mathematics: Teaching resources. (web address www.sacsa.sa.edu/companion) This document is intended to support teachers to engage with the SA Curriculum framework, and also is intended to meet “the need to promote consistency of curriculum within and across schools in South Australia”. It is also a direct response to requests from “many teachers for the requirements of the SACSA Framework to be made more explicit for each year level” (p. 3).

The source of this document and its clearly stated intentions are evidence of its standing and endorsement by SACSA.

The document relates teaching content in each Year level to Standards which comprise the SA Framework. Standard 1 is expected to be achieved by most students by the end of Year 2. Content in Reception and Year 1 is therefore described as being “Towards Standard 1”. Standard 2 is expected to be achieved by most students by the end of Year 4; and Standard 3 is expected to be achieved by most students by the end of Year 6.

Progressive development of content is organised in three-year spans: from Reception to Year 2; from Year 3 to Year 5; and from Year 6 to Year 8. This is the only Australian document to provide detailed prescriptions for course content according to individual Year levels.

In the Band: Early Years, dealing with Reception to Year 2 within the Number Strand there is an elaboration of Whole numbers, ordinals and fractions (pp. 16-17), and an elaboration of Multiplication and division (pp. 20-21). There is also a Strand: Pattern and algebraic reasoning with a separate elaboration of Pattern and algebra.

In the Band: Primary Years dealing with Year 3 to Year 5, within the Number Strand there is an elaboration of Fractions and decimals (p. 41), and an elaboration of Whole Number multiplication and division (pp. 42-43). There is also a Strand: Pattern and algebraic reasoning with a separate elaboration of Algebra.

Overall Ranking: South Australia

Detailed ****

Unambiguous ***

Measurable ***

Academic Content ***

Comment: The South Australian document elaborates its Standards with clear descriptions of core content for each Year level. These elaborations are extremely useful to teachers and schools in planning courses for particular year levels and across the school. In the Algebra section, however, while the content is elaborated relatively clearly, the use of the word “calculates” is probably too general. In this section, there could be more attention to the methods that should be taught. Overall, however, this document stands out in terms of its detail and usefulness to schools

Western Australia

The principal document used for this analysis was the Outcomes and Standards Framework published in 2005 by the Department of Education and Training, western Australia. (web

address www.det.wa.edu.au) This publication contains level descriptions and elaborations for the relevant area outcomes. The use of this document “has been mandated in the new Curriculum, Assessment and Reporting Policy (2005). Schools are required to use (this) Framework ...” (p. 1).

Achievement targets for mathematics considered in this report relate to the area of Number and to the area of algebra. In the area of Number, “aspects of Level 2” are expected to be attained by most students by the end of Year 3. One assumes that, by the end of Year 4, most aspects of Level 2 can therefore be reached. “Aspects of Level 3” are expected to be achieved by the end of Year 5, with all of Level 3 by the end of Year 7.

In the area of Algebra, there are no specific outcomes are described until Level 4. However, specific elaborations are given from Level 2 upwards for “Equivalence, equations and generality”.

Overall Ranking: Western Australia

Detailed **
Unambiguous **
Measurable **
Academic Content **

Comment: Because of the structure of its Levels - where partial achievement of Level 3 is anticipated in Year 5, and full achievement only expected by the end of Year 7 – the Western Australian document is at some disadvantage in showing clear progression in content to be taught in the areas of multiplication, division and decimals. Here only one level is cited for the primary school years. The specification of content in the other areas is much more compatible with Level structure employed in the WA document. It is anticipated that this document will be supported by other documents to provide clearer advice to schools in planning courses.

Tasmania

The principal document used in this report is the statement of Essential Learning produced by the Tasmanian Government through its Department of education, Training and Information in 2004. (web address www2.education.tas.gov.au) Within this statement performance guidelines are provided for Being Numerate as part of a larger objective, Communication. Being Numerate elaborates in a one-page overview Outcomes spread across five Standards. Standard 1 describes in broad terms the knowledge and skills that children may be expected to bring to pre-school. Standard 2 covers what may be expected to be developed from Kindergarten or pre-school through to Year 3; Standard 3 covers what might generally be expected from Year 3 to year 5; Standard 4 from Year 6 to Year 8; and Standard 5 what may be expected to be achieved beyond Year 8 for most students.

In addition to this overview document, the Department has also published Progression Statements which described three levels of attainment – Lower, Middle and Upper – for each Standard.

In order to gain a closer idea of the advice that is still provided for schools in developing mathematics programs, a sample document entitled, Derwent Primary School Mathematics

Program, was used. Excerpts of this document will be incorporated into the comparative topic grid which accompanies this report.

Overall Ranking: Tasmania

Detailed *
Unambiguous *
Measurable *
Academic Content *

Comment: Tasmania is undergoing transition. While there are many arguments in favour of 'big picture' ideas, such as Being Numerate, in evaluating and planning curricula, these big ideas are not able to assist schools at the more detailed level of planning programs for each year level and making sure that there is clear progression of content throughout the school. For this reason, it was seen as useful to refer to a sample program, still available on the Department's web-site, to see how schools can plan courses effectively within and across year levels. The "Derwent Primary School Sample Program" is certainly helpful in this regard. However, this document has a tendency to repeat advice across year levels. At the same time, it does make distinctions within these more general recommendations. Applying the same rating scale to this latter document would give a much stronger result – probably between a two- and three-star rating in the four domains.

Northern Territory

The principal document used for this analysis was the Mathematics component of the NT Curriculum framework, entitled *Mathematics Learning Area*, available electronically in 2005 from the NT Department of Education Employment and Training (DEET). The specific web address is: www.deet.nt.gov.au/education/ntcf/docs/learning_areas_maths.pdf

The Northern Territory Curriculum Framework (NTCF) "identifies learning outcomes for all Northern Territory learners in classes from Transition to Year 10. It provides the major elements of curriculum, around which schools can:

- develop flexible teaching and learning programs that are inclusive of the varied pedagogical approaches of educators
- assess learner progress
- report on the outcomes achieved.

The framework enables schools and teachers to select content and teaching methods consistent with local contexts and priorities to ensure learners achieve agreed outcomes." (<http://www.deet.nt.gov.au/education/index.shtml>)

The *Mathematics Learning Area* is set out in five Band levels up to Year 10 with an additional Band describing achievement beyond Band 5.

Achievement targets for mathematics considered in this report relate to the area of *Number Sense*. Algebra is not formally considered until Band 4 although Number patterns and relationships are considered under the heading of *Number Sense*. In this report, specific topic areas relating to multiplication and division, fractions and decimals are elaborated for *Number Sense* Band 2 and Band 3. In general, it is expected that many students will achieve outcomes at Band 2 by the end of Year 4, and of Band 3 by the end of Year 6. Year 3

National Numeracy Benchmarks are indicated within Band 2 and the Year 5 Benchmarks within Band 3.

Overall Ranking: Northern Territory

<p>Detailed ^(*)</p> <p>Unambiguous ^(*)</p> <p>Measurable **</p> <p>Academic Content *</p>

Comment: The specification of content in multiplication and division and in fractions and decimals is quite general. Teachers would need more information than is provided in this document to prepare a sound teaching program and to know what to emphasise in their teaching. The link between fractions and decimals is not made sufficiently clear. While the treatment of decimals is linked to the Base 10 number system, there is too much reliance (in Band 3) on making links to money and measurement. Addition and subtraction of fractions and decimals are not outlined in any depth. There is also very little treatment of the concept of equivalence in the primary school years.

Examples of strong and weak descriptors

Area covered	Strong	Weak
<p>Fractions & decimals Years 3 & 4</p>	<p>Stage 2 NSW Mathematics K- 6 Syllabus Models, compares and represents commonly used fractions and decimals, adds and subtracts decimals to two decimal places <i>Model, compare and represent fractions with denominators 2, 4, and 8, followed by fractions with denominators 5, 10, and 100</i> <i>Find equivalence between halves, quarters and eighths; fifths and tenths; tenths and hundredths</i> <i>Model, compare and represent decimals to two decimal places</i> <i>Add, subtract decimals with the same number of decimal places</i></p>	<p>Standard 3 Tasmania Essential Learnings - Communicating: Being Numerate (Progression statements). (Year 3 to Year 5) Understands how to explore, refine and communicate more effective ways of thinking and acting mathematically in familiar situations Middle: Students ... understand the concept of ‘a half’ in any context Upper: Students ... understand quarters and tenths</p>

<p>Multiplication Year 3</p>	<p>California: Mathematics Content Standards Grade 3 Students calculate and solve problems involving addition, subtraction multiplication and division Memorise to automaticity the multiplication table for numbers between 1 and 10 Solve simple problems involving multiplication of multi-digit numbers by one-digit numbers (3,671 x 3 = _)</p>	<p><i>Tasmania: “Derwent Primary School” Mathematics Program Year 3</i> <i>Addition, Multiplication, subtraction and division are interrelated and provide powerful ways for operating with numbers</i> There are useful patterns in the multiplication and addition tables</p>
<p>Division Year 4</p>	<p>Japan: Mathematics Program in Japan, Grade 4 Children should deepen understanding of dividing integers, should be able to do these calculations reliably, and should extend the ability to make use of them appropriately. (a) To consider how to divide when the divisor is a one- or two-digits number, and the dividend is a 2- or 3-digits number, and to understand that these calculations can be done on the same basis as more basic calculations. To understand how to do these calculations in column form. (b) To be able to divide reliably and to make use of division appropriately. (c) To investigate relations between dividend, divisor, quotient and remainder, and to represent it in the following expression: Dividend = Divisor x Quotient + Remainder (d) To investigate the properties of division, and to use the results to formulate multiplication tables, check the results and so forth.</p>	<p>New South Wales, Mathematics K-6, Syllabus <i>Stage 2</i> Uses mental and informal written strategies for multiplication and division <i>Develop mental facility for number facts up to 10x10</i> Interpret remainders in division problems</p>

<p>Decimals Year 4</p>	<p>Singapore:Primary Mathematics Syllabus Primary 4 Number notation and place value Pupils should be able to read and interpret decimals up to 3 decimal places. Pupils should be able to compare and order decimals Pupils should be able to add and subtract decimals up to 2 decimal places Pupils should be able to multiply and divide decimals up to 2 decimal places by a 1-digit whole number</p>	<p>Queensland: Mathematics 1 to 10 Syllabus Stage 3 <i>Students use a range of computational methods ... to solve problems that involve whole numbers, common and decimal fractions in context</i> Students compare, order and represent ... common and decimal fractions</p>
<p>Multiplication and Division Years 5/6</p>	<p>South Australian Curriculum and Standards Authority R-7 Mathematics: Teaching resources. Year 5 (towards Standard 3) Multiplies 2, 3 and 4 digit numbers by 1 digit Divides 4 digit numbers with divisors up to 10, with and without remainder Year 6 (Standard 3) Multiplies a 2 digit number by a 2 digit number using the extended form (long multiplication) Divides a number with 3 or more digits by multiples of 10 (including remainders)</p>	<p>Northern Territory: Mathematics Learning Area Band 3: Learners can accurately ... multiply and divide using a variety of strategies, including fluent use of mental estimation and calculators</p>

8.2 Benchmarking science

Chemical Matter	Q'land	NSW	Vict	Tas	NT	SA	WA	Sing'	Eng	Calif'
Detailed	***	*	**	*	***	***	***	****	***	****
Unambiguous	***	**	**	*	***	***	***	***	**	****
Measurable	****	**	**	**	***	***	***	***	***	***
Academic content	****	*	**	*	***	***	***	***	***	****

Physical World	Q'land	NSW	Vict	Tas	NT	SA	WA	Sing'	Eng	Calif'
Detailed	***	***	**	**	***	***	***	****	***	****

Unambiguous	***	**	**	**	***	***	***	***	***	****
Measurable	***	***	**	**	***	****	****	****	***	***
Academic content	****	**	**	**	***	***	****	****	***	****

Victoria

The Victorian Essential Learning Standards curriculum documents have been considered in the benchmarking process.

Science is described as having two dimensions: science knowledge and understanding and science at work. Overarching conceptual ideas of the science knowledge and understanding are provided.

- understanding the similarity and diversity of living things and their relationships with each other and their environment
- understanding concepts related to matter – its properties and uses, and how different substances are created through chemical change
- understanding concepts of energy and force as a way of explaining physical phenomena
- understanding the place of the Earth in time and space and the interaction between the Earth and its atmosphere.

The science at work dimension provides a focus on how science works and supports curiosity, investigations and the ways that science knowledge has been constructed. Standards for assessing and reporting on student achievement commence at level three.

In the Learning focus teachers are given guidance about what students might do. In levels one and two these are broadly focused experiences and are not always linked to particular areas of science.

In the Learning focus for levels three and four more specific guidelines and support for students' experiences are provided. In the standards sections of level three and four, in the science knowledge and understanding section, clearer references are made to particular science concepts. It does appear to presume that teachers understand the science concept and the associated difficulties students may have with the ideas being offered. In the science at work section of the standards teachers are given guidelines for the science activities students can do.

In VELs at level one and two useful details about what students should be experiencing are provided. VELs does not provide a clear indication of the science concept at level three and four but does provide guidelines for the teacher about how they may provide experiences to support the science content.

VELs succeeds in providing a sound and balanced structure for science, balancing content and skills and process very well. But, VELs presumes a higher level of science competence than that which exists widely in the primary teaching community. In particular, early career teachers may benefit from more precisely focused statements on the science content and focus that is required.

In the descriptors below a comparison of achievement of level four has been made between the Singapore science document and the VELs document. Both are seeking similar things,

but the Singapore statements offer teachers more guidance and clarity of focus.

Area Covered	Strong	Weak
Chemical Matter	<p>CYCLES</p> <p>a) state that matter is anything that has mass and occupies space</p> <p>b) describe the three states of matter (Solid, liquid, gas) in terms of their maintenance of shape and volume</p> <p>c) differentiate between the three states of matter</p> <p>d) recognise that water can exist in three interchangeable states of matter</p> <p>e) investigate the effect of heat gain or loss on the state of water</p> <p>Singapore Science Learning outcomes for Year four</p>	<p><i>Science knowledge and understanding</i></p> <p>classify a range of materials such as solids, liquids and gases according to observable properties, and understand that this system of classification of substances is sometimes problematic.</p> <p>Students describe examples of reversible and non-reversible changes in substances.</p> <p>VELS Level Three End of Year four</p>

VELS is well supported by the on-line Sample Science Program, STEPS video packages and the Curriculum@Work documents that exemplify what the science content will look like in practice. VELs appears to lack the clear science content focus that is needed to underpin the details provided in the VELs standards. VELs alone, without the Curriculum Standards Framework documents, does not support teachers as they seek to develop an integrated science program nor the development of a science program P-6.

VELs provide for the Prep/Foundation year of schooling. Each level covers two years of schooling. No indication of the time to be allotted to the teaching of science is provided and nearly all states do not provide suggested time allocations. **South Australia- Key document used**

http://www.sacsa.sa.edu.au/index_fsrc.asp?t=LA

Whilst the South Australian Curriculum, Standards and Accountability Framework has provided a clear focus for the Key Science ideas needing to be covered, it is the Science Companion Documents that provided the detailed description of the required content year by year. The latter document has been used to evaluate the advice given to schools in SA.

The South Australian Curriculum Scope and Curriculum Standards provides a clear focus on the Key Science Idea, but the suggestions for how this could be taught in the classroom are detailed for each Key science idea in the Science Companion Documents.

Teachers are provided with appropriately and well-described examples of the evidence they would need to see demonstrated in students' performance. Both the Physical and Chemical matter content is offered from the beginning of the school entry point (Primary Years Band,

Years 3, 4 and 5). The explicit science content is well supported by the Science Companion document that notably provides clear outlines for supporting each Year Level, and shows how to cater for a range of understandings and experiences.

The concern is that the Curriculum Standards documents require the very detailed support of the Companion documents. As a result, valuable teacher time has to be spent cross-referencing both documents.

Area Covered	Strong	Weak
Chemical Matter	<p>CYCLES</p> <p>a) state that matter is anything that has mass and occupies space</p> <p>b) describe the three states of matter (Solid, liquid, gas) in terms of their maintenance of shape and volume</p> <p>c) differentiate between the three states of matter</p> <p>d) recognise that water can exist in three interchangeable states of matter</p> <p>e) investigate the effect of heat gain or loss on the state of water</p> <p>Singapore Science Learning outcomes Year four</p>	<p>2.7 Designs an investigation to explore properties of common materials, explaining why they have particular uses</p> <p>2.8 Predicts, investigates and describes changes in common materials when acted upon in various ways.</p> <p>SACSA Standard two – end of year four</p>

When compared to the Singapore curriculum descriptor, the science concept is not as clearly stated in the South Australian document and, as a result, teachers have to draw on the Companion document to more fully understand what is required. Not only is such an exercise time consuming, but given the statement that “descriptors are not prescriptive”, teachers might be left with some uncertainty as to their value or legitimacy. A particular strength of the South Australian documents is the provision of guidance for a yearly program for teachers. The standards specify the details of what needs to be achieved for each level.

New South Wales- Key documents used http://www.bosnsw-k6.nsw.edu.au/http://www.bosnsw-k6.nsw.edu.au/scitech/scitech_index.html#syllabus

The NSW Science and Technology curriculum statements fail to give a concise and clear definition of the expected learning outcomes. The less experienced classroom teacher, in particular, would be better supported by the provision of focus statements that clearly outline the science ideas that are underpinning the suggested experiences that have been provided.

Area Covered	STRONG	WEAK

Physical World	<p>Systems</p> <p>a) recognise that an electric circuit consisting of an energy source and other circuit components forms an electrical system.</p> <p>b) recognise that a current can only flow through a closed circuit.</p> <p>c) recognise that</p> <ul style="list-style-type: none"> - dry cells / battery provides energy in a closed circuit - current transports energy from the dry cells / battery to the bulb - a switch can be used to break or close a circuit. <p>d) construct simple circuits from circuit diagrams.</p> <p>e) infer that components of an electrical system affect one another.</p> <p>f) identify electrical conductors and electrical insulators.</p> <p>g) show an awareness of the need for proper use and handling of electricity.</p> <p>h) show an awareness of the need to conserve electrical energy.</p> <p>Singapore Grade 5</p>	<p>Identifies and applies processes involved in manipulating, using and changing the form of energy.</p> <ul style="list-style-type: none"> • here are various forms of energy. • a complete circuit is needed for an electrical device to work. • the sun is the source of most of the energy on the Earth. • light can pass through some materials and not others, and when it does not shadows form. <p>determines, records and reports on the conditions necessary for an electrical circuit to operate, eg light a bulb</p> <p>devises a fair test to find out which materials conduct electricity most effectively and shares findings</p> <p>NSW GRADE 5/6 STAGE 3</p>
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The Singapore material for a grade 5 class, focusing on electricity, is clearly defined and the teacher is clear about the experiences students are to undertake. The NSW material covers two years of schooling and does not offer the teachers the same degree of detail.

Teachers and students need to be able to see the connections and distinctions that are being made by the activities. These documents are strong in process and skills but could benefit from enhanced explanations that link the experiences to clear science knowledge as per the example above from the Singapore curriculum document. The Physical World syllabus provides more readily identifiable science ideas than can be found for the Chemical focus. This could be a disadvantage for the relatively inexperienced teacher.

The support documents that are still available on line do provide a very sound structure for teachers to create meaningful and balanced science lessons and units. Teachers do have to be prepared to find the time to access the documents and take the time to consult them.

Tasmania- Key document

<http://www.education.tas.gov.au/ocll/publications/outcomesandstandards.doc>

Although the experiences and activities suggested are appropriate and support the science

processes and skills strongly, the key science concepts are difficult to locate in the key document. It could be reasonably anticipated that only the experienced teacher would be able to make the connections between the classroom activities and the science idea that was meant to be investigated, explored and understood. The Tasmanian documents, to date, provide less structure and guidance for teachers in both the areas of Physical World and Chemical Matter. Teachers have little guidance as to the science concepts being developed or clarity or purpose that would help them understand what students are meant to achieve. It is expected that teachers, especially less experienced teachers, would need further support and guidance in order to provide the science content necessary for a balanced curriculum.

Western Australia- Key documents

<http://www.eddept.wa.edu.au/cmis/eval/curriculum/learningareas/science/index.htm>

<http://www.curriculum.wa.edu.au/pages/framework/framework02.htm>

The Western Australian Curriculum framework documents provide guidance for teaching all students by providing a framework of learning outcomes. Teachers are to use the learning outcomes provided, combined with the overarching statements, to develop responsive programs for their particular students. Although the framework does not appear to be mandated, it does include the learning areas that are endorsed by the Australian Education Council.

In the Outcomes and Standards Framework document, student achievement is explicitly described and the science connection is readily identified, understandable and appropriate. The science statements concisely, but also in an informing manner, state what science ideas are to be taught. The document is both easy to navigate and it is easy to make sense of what is required at each of the particular levels which are described in three levels (Foundation, Level one and Level 3 for the primary years).

The Western Australia documents detail in a clear and concise way the science focus required. Teachers are easily able to identify the focus for lessons and ensure that the activities suggested contribute to a rich understanding in both Physical and Chemical science. The science program begins in the first years of schooling and develops understandings and skills sequentially for the following years of primary school.

It is particularly easy to follow through a science concept and see where it is introduced and when it is being revisited and progressively developed through out the document. It is evident that students could be introduced to the idea of energy transformations at level one and then again in level two. Student understanding is strengthened as key science concepts are revisited, giving students several opportunities to encounter particular learning outcomes.

Queensland- Key document

<http://www.qsa.qld.edu.au/yrs1to10/kla/science/syllabus.html>

Queensland documents are the only documents to provide a set of precisely stated and overarching 'key science concepts' that are then developed into specific learning outcomes for four levels, embracing the primary schools years Level one to Level 4 (in part). These 'key concepts' are readily identifiable and succinctly explained in ways that teachers can quickly understand and implement.

The examples of the science experiences provide teachers with clear ideas about what the students can and need to be doing. Physical science and chemical science are well

supported with appropriate guidelines and examples. The science begins to be taught and developed at the beginning of the early school years.

Northern Territory

Key document used

<http://www.deet.nt.gov.au/education/ntcf/index.shtml>

These documents are well articulated and follow a development sequence that provides an appropriate, and useful, level of detail for both science ideas in the Physical and Chemical focuses. Sound guidance as to the evidence required for recognising student achievement is also provided.

A concise document that offers teachers enough, but not an overwhelming amount of detail, related to the science content and learning levels to be achieved. It has similarities to other state documents and introduces science concepts at about the same levels.

It deals with ‘forms of energy’ earlier than Victoria, South Australia and Western Australia, but at the same time as Queensland and New South Wales. Northern Territory, like most states, except Tasmania and New South Wales, deal with the science idea of ‘transformation of energy’ at the same level in the grade 4/5 or 6 of primary schooling.

These documents are concise and provide a useful package that enables teachers to quickly see what is required in terms of essential science learning. The science curriculum details are provided in 28 easy to follow pages, balancing clarity about the science concept with an indication of what the science standard will look like in practice.

Australia in summary

Most states have relatively new documents and are generally less than four years old. The focus on ‘essential learnings’ is prevalent. The structure and content is relatively similar; with students having two or more years to move through the learning outcome statements. Of interest, is that the Singapore and the California documents relate to specific year levels instead of bands that incorporate a number of years.

The concern here might be that outcomes spread over two years could be missed, as teachers may assume that other teachers in the other grades completed the related teaching. Also, many concepts in science require revisiting as they are conceptually challenging and conflict with the experience of everyday living, so it maybe necessary to explore and revisit some concepts in different ways. Another concern, if schools decided to have a biannual focus on science as a curriculum area, is that science might not be taught at every year level on an annual basis. Students are more likely to benefit from regular science teaching.

Only one state (NSW) has Science merged with Technology. Not all states have a program specifically for the first year, but many do, referring to this as the Foundation or Preparatory year. Young children, through play, can actively exercise their curiosity and become aware of different ways to view and think about the world. Such an approach is worthwhile, as science is a way that young children can be encouraged to begin to explore and think about their world and their relationship to the events within it.

Across all the states and territories similar content is present at approximately the same level and is developed in a broadly similar order. For example, the science concept of energy and

its sources and changing forms appears in most documents for completion by about Year four. In most documents students are expected to be able to distinguish when energy is transferred by the completion of Year six. Victoria, Queensland, Western Australia, Northern Territory and South Australia documents are very specific about the science concepts for energy. NSW documents provide examples of this concept, but do not articulate it as clearly in their statements. Victorian and Queensland documents describe 'transfer' and 'transformation' of energy as learning outcomes for all students. NSW documents do not appear to use these terms at all.

Education departments and curriculum authorities all offer substantial science support material for suggested teaching activities. The materials provided are of a generally very high and comprehensive level. The only cautionary note is that these support materials should exemplify clear science learning outcomes in the key curriculum documents referenced above. If not, the concern is that teachers may become disconnected from the science focus and immersed in the activities for the 'activities sake'. The primary school science experience should be rich in science experiences and science activities. But the teacher also needs to see and show the connections and patterns that link from their activities to the 'big ideas' in science. For example, in Particle Theory one main idea is that 'heat changes the behaviour and property of materials and matter'. This science concept underpins many science topics areas and pervades much science teaching, but can be ignored if the teacher is not focussed on the idea behind the science activity as he or she concentrates on organising the science activity being offered.

Teachers, especially relatively inexperienced teachers and those not feeling confident about teaching science concepts, need to be aware of and focussed on the science content that is being dealt with in their teaching program. Without a clear focus on the key science idea in a lesson, activities and projects can become the focus and are completed for the activities sake, rather than the science embedded in it. This is a critical point to consider given the fact that not all primary teachers have an academically strong background in science. The discussions that surround the classroom activities should exemplify the key science concepts, and how humans understand the world and have made sense of it. This would be made easier for the teacher, and more effective for their teaching, if they were clear about the science idea that was being focussed on and, thus, being provided in the science activity.

The key science documents throughout Australia are generally of a high standard. Most important for teachers is that the science concepts are clearly stated, that the teaching examples exemplify the concept and that the standards precisely indicate what is to be achieved or aimed for in the classroom. Support material may provide classroom activities that indicate how the science concept may be taught, but teachers now seem to have a large range of support materials, and may prefer to have succinct explanations to the background understanding to the embedded science concepts. Therefore, the key documents must state clearly what the science focus is meant to be and then provide examples that highlight the science concept.

Notably absent from all but one state document (QLD) is any reference to time that should be allotted for the teaching of science. This is probably because science may be integrated with other areas in some primary programs. But guiding principles for estimating time would be helpful. If time allocations are not provided there is the real danger, given the crowded curriculum, that science will slip off the classroom program.

Most documents acknowledge the innate interest students have in their world and their desire to understand it. Primary aged children are more likely to understand the world and the science principles incorporated within it if they are regularly engaged in wondering, pondering and questioning the world through experiences and activities in science.

For year 4 students, the proportion of Australian students reaching the Advanced International benchmark has declined since TIMSS 1994/5. In 1994/95 13% of Australian students reached the Advanced level and this fell to 9% in the 2002/03 test (Thomson and Fleming, 2004a p 21). Singapore has one quarter of its students operating at the Advanced level and two-thirds reached the high level. England came second in the Advanced level with just under 50% of their students operating at a high level. England, with a score of 74%, was the highest achieving country in the TIMSS 2002/03 study in the Year 4 Science Content Area of Physical Science at the point when students were asked to describe the difference between a solid and a liquid. On the same question Australia scored 64% and Singapore scored 73%. Internationally 44% of students at year 4 correctly responded to this question. (See Thompson and Fleming, 2004a, pp 20, 27 and 29)

When asked to interpret a question on material properties from the Physical World material 39% of Year 4 Australian students were correct compared to 74% of Singapore students. According to the curriculum documents of most Australian states, this material is included and the expectation is that it should have been taught. But students have not all grasped the science ideas as expected⁸⁸. This needs to be considered or investigated for the factors that have contributed to the lack of understanding that is evident for many students. Were the science ideas identified by the teacher and then covered explicitly with the students? Were the activities more like distracters from the main science content to be covered? Was the material ever taught?

Chemistry is not a science content domain in TIMSS for year 4 but is merged into Physical Sciences. But notably in Year 8 Australian students score weakest in Chemistry (ACER TIMSS Report, 2002, p 45). Interestingly, some states in Australia, notably Tasmania and New South Wales, have a minimally stated emphasis on chemistry in their primary school curriculum documents.

England National Curriculum

Key documents

National Curriculum in Action

<http://www.naction.org.uk/subjects/science/index.htm>

Schemes of Work

<http://www.standards.dfes.gov.uk/schemes2/science/sci1d/?view=list&column=outcome>

Attainment Targets

[http://www.nc.uk.net/webdav/servlet/XRM?Page/@id=6001&POS\[@stateId_eq_main\]/@id=6323&POS\[@stateId_eq_at\]/@id=6323](http://www.nc.uk.net/webdav/servlet/XRM?Page/@id=6001&POS[@stateId_eq_main]/@id=6323&POS[@stateId_eq_at]/@id=6323)

The primary program is covered by Key Stages one and two. The National Curriculum document is supported by the National Curriculum in Action document that shows what the

⁸⁸ As acknowledged earlier in this report, the intended curriculum is a necessary, but not sufficient condition for sound learning. What actually happens in the classroom is also vitally important.

science curriculum looks like enacted in practice in Year Levels. Detailed schemes of work are available on line (See below).

Attainment targets for each level are provided alongside the key Knowledge, Skills and Understanding for each of the five areas of science (Scientific Inquiry, Life Processes and Living Things, Materials and their properties, Physical Processes).

The structure of the English national Curriculum (Science) is somewhat similar to Queensland's approach to its science documents. A few key concepts are identified and then sequentially developed through several levels. The National Curriculum documents provide a developmental sequence for every Level, which covers two years of schooling, as well as detailed targets in the Attainment Level materials for each grade level.

In the report 'Where England stands in TIMSS 2003', which examines what factors are identified in the English education system that are associated with mathematics and science achievement, one important factor relates to how teachers teach. In particular:

the use of investigation and explanation in science was a significant predictor of achievement in all areas. (p. 282).

English schools scored high, internationally, on the 'hands-on approach' to teaching science in primary schools. English teachers also scored highest on time spent with working 'with teacher's guidance'. Ten percent of teachers' time was spent re-teaching and or clarifying concepts. This is an interesting use of time that may not be factored into the time needed to teach science.

Singapore

http://www.moe.gov.sg/cpdd/doc/Science_Pri.pdf

The Primary Science Syllabus is available on line and is a concise document of 36 pages. One of the distinctive features of the Singapore document is a column that runs alongside the Learning Outcomes called Remarks. Remarks articulate what the students will do and NOT do. As a result, teachers are sometimes specifically directed to focus or not to focus on an aspect of their teaching.

- Pupils need to relate the following plant parts to their role in photosynthesis:
 - leaves where photosynthesis takes place
 - roots which anchor the plant and take in water and minerals
 - stems which support the plant to get sunlight and transport water through the stem to the leaves

And

- Pupils are not expected to give detailed descriptions of the processes but should know the sequence of events.

Five themes are chosen to cover the science knowledge and understandings to be taught, these are Diversity, Cycles, Systems, Energy and Interactions. The 'Essential Learnings' are listed and developed under each topic and are revisited in the subsequent year levels.

Science is not taught until year three, but then a comprehensive curriculum is provided for each year level. Another notable feature is the constant revisiting of the themes and the

interlinking with previous ideas already covered. The Singapore science syllabus is concise while still able to clearly articulate essential science learning. This is the overall strength of the document. The document is able to succinctly convey the science to be taught, providing a focus and the standards required for teaching.

Although no time allocation is provided, it is apparent that to successfully cover this material in one-year science must be taught on a very regular basis. The content is focussed and provides depth and sound coverage. The yearly focus seems to require fewer areas to be covered, but this provides an opportunity for teachers to invest their time and to develop quality science understandings that can later underpin multiple and diverse topics.

Another significant difference in the Singapore education system is the type of support materials to underpin the approved curriculum. Singapore teachers are provided with Primary Science Text books for each year level in primary classes. The textbooks are government approved and closely match and support the intended curriculum documents.

California

The curriculum document describes essential learning as science content *standards*. They are described as both comprehensive and specific and in 18 pages the document covers the primary school science curriculum. The science areas are divided between Physical Science, Life Sciences, Earth Science and Investigation and Experimentation. A detailed guide is provided for each year level. The area described as Physical Sciences includes material that deals specifically with both the Physical World and Chemical Matter and the focus changes from year to year. In years K, 1, 3 and 5 the material has a chemistry focus and in years K, 2 and 4 the emphasis is on physics.

The points covered in the documents detail what students are to know and statements are prefaced with the phrase, “Students know...”. The result is that teachers have a clear road map of essential science learning that needs to be addressed in the classroom. The California standards state that in Grade Four students meet with an overarching idea that:

Electricity and magnetism are related effects that have many useful applications in everyday life. As a basis for understanding this concept:

Examples are then provided and include:

- a. *Students know* how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs.
- b. *Students know* how to build a simple compass and use it to detect magnetic effects, including Earth’s magnetic field.
- c. *Students know* electric currents produce magnetic fields and know how to build a simple electromagnet.

The documents clearly describe the science content as ‘what to teach, not how to teach it’. The teachers are able to develop the best ways to work with their students to develop the science concepts. They are described as the foundation for teachers work and not as additional layer. The documents acknowledge that they are meant to support teachers teaching outside their area of expertise. Teachers in Kindergarten to Grade three are expected to integrate science into literacy and numeracy activities, where appropriate. All students are expected to use literacy and numeracy skills in meaningful ways in science. 20%

– 25% of time is given to hands-on activities.

8.2 Benchmarking English

Literature	Q'land	NSW	Vict	Tas	NT	SA	WA	Calif'	Eng	NZ
Detailed	***	**	**	**	**	***	**	****	***	**
Unambiguous	**	**	**	**	**	***	*	****	***	**
Measurable	**	**	**	*	**	**	*	****	**	**
Academic content	**	**	*	*	**	**	*	****	***	**

It should be noted that the focus of the analysis is on literature as a subject. Especially in primary school, literary genres such as myths, fables and legends deal with emotions, predicaments and spiritual values that address the underlying need for children to understand and deal with human nature. Psychological and emotional maturity depends on children encountering a rich and diverse range such literary texts⁸⁹. It should also be noted, unlike the mathematics and science analysis, the following does not draw on international tests such as TIMSS and TIMSS-R to inform the comparative analysis.

The Californian and the English intended curriculum clearly define literature in terms of its different genres (for example, myths, fables, poems, fiction) and the types of literary skills associated with the subject (such as recognising patterns of rhythm, rhyme and sounds in poems and identifying figurative language use represented by simile, metaphor and hyperbole). The Australian and New Zealand documents deal with literature within the general category of 'text' and focus on a critical literacy approach that focuses on looking at texts within a socio/cultural context. In opposition to emphasising important knowledge and content, a critical literacy approach focuses more on the affective domain by requiring students to develop particular attitudes and dispositions related to deconstructing texts in terms of their socio/cultural significance.

The distinction between these two approaches (what are sometimes defined as a cultural literacy and a critical literacy approach) has a significant impact on how the subject is presented in the classroom. Psychological and emotional maturity depend on children encountering a diverse range of literary texts. A critical literacy approach, on the other hand, asks children to deconstruct texts in terms of how readers are positioned by the author and to identify the way texts privilege certain readings over others. Instead of valuing literature for its aesthetic or moral influence, the focus is in the way in which texts disadvantage marginalised groups and validate the interests of more powerful groups in society.

England

The English national curriculum English document clearly distinguishes between what is called literature and non-fiction and non-literary texts. There are some 15 curriculum descriptors over the years 1 to 6 detailing what should be taught; such descriptors range from more technical aspects of literature (identify patterns of rhythm, rhyme and sounds in poems and their effects) to justifying interpretations of text (express preferences and support their view by reference to texts). Teachers are also given guidance as to the range of texts to be covered. In addition to modern fiction, mention is also made of traditional folk and fairy tales, stories and poems from a range of cultures and myths, legends and traditional stories.

⁸⁹ See, for example, the works of Bruno Bettelheim, Joseph Campbell and Jung.

As opposed to the majority of Australian documents that adopt a critical literacy approach to literature, focusing on students adopting politically correct attitudes and dispositions, the English curriculum has a strong literature discipline base.

New Zealand

The New Zealand document acknowledges the value and importance of literature in the general section of the document, but when looking at the achievement objectives there appears little, if any, mention of literature as such. As with many of the Australian documents, literature, as a category, is subsumed by the description 'texts'. Under the heading of personal reading and close reading teachers are given 8 descriptors. Descriptors such as "select and read independently, for enjoyment and information, a range of contemporary and historical texts, integrating reading processes with ease" and "discuss language, meanings and ideas in different texts, relating them to personal experience (L2)" give no idea as to what texts should be read or the standard required. There appears to be little increase in complexity or difficulty over the levels.

California

California Language Arts curriculum includes: *English-Language Arts Content Standards for California Public Schools* that outlines year level standards to be taught in schools, a *Reading/Language Arts Framework for California Public Schools* and *Recommended Readings in Literature, Kindergarten Through Grade Eight* (California Department of Education 1996a). The second document is described as "a framework that offers a blueprint for implementation of the language arts content standards adopted by the Californian State Board of Education". Of interest is that the document includes explicit guidance to teachers about how the standards can be implemented and assessed in the classroom. Teachers are given detailed guidance as to the expectations about student learning and various strategies to achieve them. For example: "Students in the fourth grade will continue to learn about fundamental elements of literature that will allow them to appreciate the rich quality and complexity of materials they read. The elements include describing the structural differences between fables, myths, fantasies, legends, and fairy tales as well as defining and identifying simile, metaphor, hyperbole, and personification in literary works". The California document does not adopt a critical literacy approach to literature and the curriculum descriptors focus on essential learning with a strong discipline focused approach. There is a clear progression in terms of complexity and difficulty of the standards as students move through school. *Recommended Readings in Literature, Kindergarten Through Grade Eight* lists high-quality, complex literary materials to be read by students.

Victoria

Victorian Essential Learning Standards (VELS Overview, 2005, p 8) comprises "learning focus statements (these outline the learning that students need to focus on if they are to progress in the domain and achieve the standards at the levels where they apply)' and 'standards' (define what students should know and be able to do at different levels of schooling...They are, in effect, outcomes against which student achievement will be assessed and reported on...). Unlike the California document that deals specifically with literature, the Victorian document focuses on the general category of texts. There is some reference to reading skills related to literature, eg "Students reflect on the way imagery, characterisation, dialogue, point of view, plot and setting contribute to the meaning of written and multimodal texts", but not with the same clarity or detail as the Californian document. While standards descriptors such as "They analyse these texts and support interpretations with evidence drawn

from the text” (level 4) fail to give a clear statement of the intended outcome , there is a sense of increasing levels of difficulty as students progress through the levels.

Western Australia

Western Australia documents include the *Curriculum Framework* and *Curriculum Framework Curriculum Guide English K-12 (Draft)*. While mention is made of literature in both documents, the more general description of texts is given greater emphasis and recognition. The approach to English adopted emphasises a critical/literacy approach to the learning area, for example teachers are asked to ensure that students: “...understand that individuals, groups and concepts can be represented in different ways in different texts and that differences in representation reflect differences of opinion and belief. They analyse how texts and ways of reading encourage certain ways of thinking and ignore or marginalise others. They understand the way in which stereotypes can reinforce preconceptions about certain social groups and may serve the interests of some groups and disadvantage those of others (p 86)”. The curriculum descriptors in the *Curriculum Framework* are general and give little, if any, clear guidance to teachers, eg the statement: “They study texts which reflect and challenge their own experience and values, and those which offer access to new experiences and values. The study of a wide range of texts provides students with the opportunity to reflect on different values and value systems and assists in the development of their own values”, begs the question as to what values are being referred to and if there are particular values to be given priority. Given the lack of detail and clarity in the *Curriculum Framework* document the Curriculum Council, in 2005, produced a *Curriculum Framework Curriculum Guide* to give English teachers a clearer and more detailed outline of expected student learning. While this document seeks to give teachers descriptors with greater clarity and detail, many are still generalised and vague. The descriptor (Reading Middle Childhood): the focus of learning is on “becoming active meaning makers through critical reading and thinking strategies”, in addition to the jargon, fails to detail what is meant by “thinking strategies”. Once again, there is evidence of a social critical approach to literature in descriptors such as (Reading Middle Childhood) “groups of people may be represented by stereotypes (eg girls wear pink and play with dolls; boys wear blue and play football) and very little, if any, reference to literature as a subject. The *Curriculum Guide* provides so many examples under the various curriculum outcome statements that there is a danger that teachers are overwhelmed with the detail.

New South Wales

The NSW *English K-6 Syllabus* provides in some detail what is involved in teaching English as a subject. The document is over 100 pages in length and includes **outcomes** (“syllabus outcomes are specific statements of the results intended by the syllabus... The outcomes are statements of the knowledge, skills and understanding expected to be gained by most students...”), **indicators** (“an indicator is a statement of the behaviour that students might display as they work towards the achievement of syllabus outcomes. The indicators included in the syllabus are examples only”) and a **Content, Scope and Sequence** section. The NSW syllabus adopts the more general definition of text as: “In this syllabus, the word ‘text’ is used broadly as any written, spoken or visual communication involving language. It will include picture books, novels, newspapers, letters, conversation, speeches, performances of plays, feature films, television programs, computer graphics and advertisements” p 5. Across stages 1-3 there are 12 outcome descriptors related to reading with some 15 to 20 indicators given as possible illustrations for each outcome statement. Many of the curriculum descriptors show little evidence of any increase in complexity or difficulty across the levels (see, for example RS1.5-RS2.5-RS3.5). Very few of the indicators deal with the technical

aspects of literature and most fail to give teachers a clear and unambiguous expectation of what is required. For example, at Stage 3, to illustrate RS3.5 teachers are given the following indicator “interprets a variety of literary and factual texts”. Such a statement begs the question of what types of texts and at what level of ability.

As a result of reviewing how school curriculum was implemented during the 90s, the second Eltis Report (DET 2003) recommended simplifying the intended curriculum documents as teachers felt overwhelmed by the complexity and number of curriculum descriptors. NSW *Consultation Paper: Defining Mandatory Outcomes in the K-6 Curriculum* seeks to reduce the number of outcomes and to identify those that will be mandatory. Under the heading ‘Reading’, across Stages 1 to 3, some 12 descriptors are listed. The general description ‘texts’ is used and there is no mention of literature or the types of knowledge, understanding and skills associated with the subject. Statements such as “Discusses the text structure of a range of text types and the grammatical features that are characteristic of those text types” (Language Structure and Features (Stage 2) fails to define what is meant by “text structure” or identify which “grammatical features” need to be covered. In simplifying and reducing the number of outcome statements, it appears that the mandatory outcomes document has compromised rigour and depth.

Tasmania

Unlike the majority of states and territories, that divide the intended school curriculum in key learning areas, Tasmania defines the curriculum in terms of 5 essential learnings: personal futures, social responsibility, world futures, thinking and communication. The Tasmanian Essential Learnings Framework defines essential learnings as describing: “...deep understanding that students need to develop now and draw upon in the future as active, responsible citizens and life-long learners”. The document *Essential Learnings Outcomes and Standards* details “expectations for student achievement” divided into levels 1 to 5”. Whereas literature, in the other Australian documents, is often subsumed within the general category of text, within the intended Tasmanian curriculum, literature is dealt with under the category of arts. Within the essential learning area *Communicating Being Arts Literate*, the key element outcome is described as: “Understands the purposes and uses of a range of arts forms – visual arts, media, dance, music, drama and literature - and how to make and share meaning from and through them. Uses with confidence and skill the codes and conventions of the art form best suited to their expressive needs”. As the standards are generic, relating to a range of arts forms, there is no mention of the types of knowledge, understanding and skills specific to literature. Standards like “Understands how to construct and deconstruct arts works designed with particular intentions” (Standard 4) is so generalized and vague that teachers would find it difficult to interpret. The illustrations offered, such as “Use specific skills, techniques and processes appropriate to particular audiences and purposes” and “Describe how arts works may communicate multiple meanings” fail to clarify the matter. The descriptors in the essential learning area *Communicating Being Literate*, while providing better direction, are still flawed. Standard 2 “Understands how to use basic structures, features and strategies to communicate in a variety of contexts for a range of purposes” fails to define what is meant by ‘basic structures, features and strategies’ or to detail the relevant ‘variety of contexts for a range of purposes’ and whether some should be given precedence. Illustrations like “Discuss the meaning of familiar texts and incorporate relevant structures and features into their own communications” and “Recognise that texts can be constructed differently to convey different messages” do little to clarify matters.

Queensland

Queensland document *Smarter Learning: The Queensland Curriculum Assessment and Reporting Framework* (April 2005). P 2 states “The new framework will define the essential curriculum and set standards of achievement for students across the state from the Preparatory Year to Year 10” Outcomes are described as “Learning outcomes provide a framework for planning for learning, teaching and assessment by describing what it is that students should know and be able to do with what they know”. The *English Years 1 to 10 Syllabus* (being trialled 2005/2006) describes the approach to the subject in the following terms: “A sociocultural-critical model of language underpins this English syllabus. The syllabus also draws on key features of a variety of other approaches to the teaching of English. These include cultural heritage, personal growth/process, skills (including phonics, spelling, punctuation), genre and critical approaches, and multiliteracies” (p 2). Under the heading ‘outcomes’ the purpose of the syllabus is described as: “It details what students should know, and can do with what they know, in Years 1 to 10 English key learning area”. The syllabus is divided into the following three strands: Cultural: making meaning in contexts, Operational: using language systems and Critical: evaluating and reconstructing meanings in texts and three substrands: Speaking and listening, Reading and viewing and Writing and shaping. Evidence of the document’s adoption of a critical literacy approach to the subject is found in the description of the Critical Strand (p 6):

- The Critical strand focuses on evaluating and reconstructing meanings in texts, using knowledge of how discourses shape, and are shaped by, language choices.
- When students interpret and construct texts, they understand that texts are someone’s “story”, that they are partial and selective, and that they represent some interests more than others.
- Students know ways particular language choices position listeners, readers and viewers, and invite them to make particular meanings. They know that representations of people, places, events, things and concepts are selective constructions. They make judgments about how particular language choices influence possible meanings. They construct representations that position other listeners, readers and viewers.
- Students understand how discourses influence the interpretation and construction of textual representations. They demonstrate understandings that, while texts invite particular meanings, alternative meanings are possible.

While the Queensland document’s treatment of literature is not as detailed or comprehensive as the English and Californian documents, teachers are given a generally clear and succinct explanation of expected outcomes related to reading and viewing. For example, students: “identify the main topic, key events and supporting details of a text and recall key events in sequence” (Cu 2.2). Other descriptors are less explicit, for example: “familiar texts have their own basic stages (generic structure) (L1 Linguistic resources) and “select texts for own reading and viewing purposes using knowledge of text types” (Cu3.2). While there is very little reference to literary genres or the types of skills associated with literary appreciation, a number of descriptors deal explicitly with grammar and syntax, for example “subjects need to agree with verbs” (Op 3.2 Linguistic resources) and “clauses can be combined, using conjunctions, to form compound and complex sentences that elaborate subject matter (Op 3.2 Linguistic resources). Compared to the English and New Zealand documents, there is a large number of outcome statements and accompanying illustrations that have the potential to overwhelm teachers.

Northern Territory

Similar to Tasmania, where the school curriculum is defined in terms of *Essential Learnings*, the Northern territory curriculum, instead of defining the curriculum in terms of subjects or disciplines also adopts an approach based on what is termed *EsseNTial Learnings*, the justification for such an approach being that:

All learners will need to adapt constructively and respond creatively and ethically to the diverse challenges posed by rapid global change throughout their lives. In this context, future generations will require both the capacity and commitment to successfully negotiate and develop socially just, ethical and sustainable futures. This will require a strong sense of self and connection with the communities to which they belong.

DEET, undated, p 17

The essential learnings are described as the foundation for “connected life-long learning, and are essential in preparing students for complex future life roles”, the statement is also made that “learning outcomes include capabilities, understandings and dispositions that students develop across their schooling years”. The domains associated with essential learning include the: inner learner, creative learner, collaborative learner and constructive learner. Each of the 4 domains is further divided into 17 outcomes that are then mapped out over the 5 bands and 3 key growth points with the expectation that the “outcomes are developed through the content of relevant learning areas” (p 2). The Northern *Territory Curriculum Framework* includes outcome statements that are mandatory and indicators that illustrate ‘what students might do’ and are not to be considered a criteria or checklist.

The *English Learning Area* document, unlike the California and England documents that deal with literature as a specific subject, similar to the other states and territories, deals with literature within a broader category, described as ‘Texts and Contexts’. The strands listed are: Listening and Speaking, Reading and Viewing and Writing and outcomes and indicators are organised into 3 elements: Texts and Contexts, Language Structures and Features and Strategies. Once again, there is evidence of a critical literacy approach with descriptors such as: “discuss how people from different genders, socio-cultural groups or people in particular roles are represented in texts and whether these representations are accurate or fair (Band 2, Texts and Contexts) and “identify and analyse biases and stereotypes in texts, eg discriminatory language, illustrations” (Band 3 Texts and Contexts). On the whole the descriptors related to the Key Growth Points are vague and generalised, for example: “recognise some elements in texts” (R/V KGP2.2) and “demonstrate emerging awareness and use of symbols and conventions to make meaning from texts” (R/V KGP3.2) fail to detail what elements, symbols and conventions are being referred to and what types of text should be included. In relation to many of the Outcome statements, the same criticism applies with descriptors like: “recognise and interpret basic language structures and features of texts” (R/V 1.2) and “identify and use the language structures and features of texts to construct meaning” (R/V 2.2) failing to give teachers a detailed and unambiguous description of what is required. While there is some truth in the argument that the indicators will better illustrate what particular key growth points and outcomes might refer to, this is not always evident. The indicator: “make meaning using noun-pronoun (cat-It) and subject-verb (cat chases) links across simple and compound sentences when reading, eg ‘The cat has fur. It chases mice’” (Band 1 Language Structures and Features) is clear and to the point, whereas “identify letter names and the variety of sounds they may produce” (Band 1 language Structures and Feature) fails to specify what is to be expected and what constitutes mastery. An additional problem is that not only are there approximately 20 indicators for each band and for each

outcome descriptor, thus overwhelming teachers, but teachers are told that the function of the indicators is to suggest what students *might* do and they should not be used as a checklist. Given such a comment, one wonders on what basis the indicators have been chosen and whether some should be considered more privileged than others.

South Australia

The South Australian Introduction to Essential Learnings and the SACA Framework document describes essential learnings as the: “understandings, dispositions and capabilities which are developed through the Learning Areas and form an integral part of children’s and students’ learning from birth to Year 12 and beyond. They are resources which are drawn upon throughout life and enable people to productively engage with changing times as thoughtful, active, responsive and committed local, national and global citizens. Engaging with these concepts is crucial to enhancing the learning culture within and beyond schools/sites”. The 5 Essential Learnings are described as: Futures, Identity, Interdependence, Thinking and Communicating and are embedded in the curriculum, including learning areas such as English. In addition to **essential learnings**, the SA curriculum documents also include: **key ideas** (fundamental concepts within a Learning Area strand), **standards** (the expected performance of a student at the end of a 2 year period) and **examples** (qualities of performance demonstrating that the learner has achieved the outcome). In relation to the standards, standard 1 is aligned toward the end of year 2, standard 2 is aligned toward the end of year 4 and standard 3 toward the end of year 6. The English SACSAs Framework document organises English into 3 strands: texts and contexts, language and strategies. Once again, the SA approach subsumes literature within the general category of ‘text’ and is based on a critical literacy model, seeking to develop in students: “a knowledge of a broad range of texts and the capability to critically analyse these texts in relation to personal experiences, the experiences of local and global communities, and the social constructs of advantage/disadvantage in order to imagine more just futures”(p 59). Descriptors such as: “analysing how values, attitudes and beliefs may be represented in written and visual texts (eg use of violence in video games; gender stereotypes in relation to characters’ roles; the ways culture is represented in television soaps; and gender, ethical and moral issues on websites, p 68) and “demonstrates critical awareness of the situation and sociocultural context (eg investigates ‘Why are the aged presented this way?’, ‘Is this the same experience for everyone? P 69). Within the Text and contexts strand, texts are divided into 3 categories: literature, media and every day texts; literature is further divided into: classic, contemporary and popular. Two documents have been examined: the SACSAs Framework English and the SACSAs Companion Document Series R-7 English Teaching Resource. One of the justifications for the second document is that teachers expressed the need “for the requirements of the SACSAs Framework to be made more explicit for each year level” (DECS 2003, Forward). In line with the majority of Australian state and territory curriculum documents the examples or descriptors in the companion document are not considered mandatory; teachers are told: “The descriptors are not prescriptive, as learning does not develop in a linear fashion. The dot points describe the possible growth points of learners as they progress towards demonstrating Outcomes to reach the standard” (DECS, 2003 p6). The companion English document also organizes descriptors in terms of listening and speaking, reading and viewing and writing. There are a number of concerns related to the companion document. Firstly, teachers are presented with some hundreds of descriptors that lend themselves to a checklist mentality in terms of ensuring students cover the necessary ground. Secondly, the question has to be asked, are all the descriptors of equal value or importance? If a key criteria for strong descriptors is that they define essential knowledge, instead of adopting a scatter gun approach, it is better to list fewer descriptors

while ensuring that they deal with key knowledge, skills and understanding.

Early years of reading

Early years reading	Q'land	NSW	Vict	Tas	NT	SA	WA	Calif'	Eng	NZ
Detailed	**	***	**	*	**	**	**	*****	***	*
Unambiguous	**	***	**	*	**	**	**	*****	***	**
Measurable	**	***	**	*	**	*	**	*****	***	*
Academic content	**	***	*	*	*	*	*	*****	**	*

Note: The early years reading analysis is the result of work carried out by both Dr Donnelly and Dr Hempenstall (BSc, DipEd., DipSocStudies, DipEdPsychs, PhD. MAPsS) Senior Lecturer, Division of Psychology, School of Health Sciences, RMIT University. Dr Hempenstall is an educational psychologist with a particular interest in academic and behavioural problems. He also works within the RMIT Psychology Clinic and supervises the clinical experience of post-graduate students in the area of educational assessment and intervention. Dr Hempenstall has written widely on the early years of reading⁹⁰ and the title of his doctoral thesis is: *'The effects on the phonological processing skills of disabled readers of participating in direct instruction reading programs'*.

One of the most crucial tasks in the early years of primary school is to teach children to read. Since the early 1970s, across the English-speaking world, there has been a good deal of controversy and debate about the most effective way for this to occur. Broadly speaking, the debate can be characterised as involving those committed to the 'whole language' approach (associated with OBE) and those who advocate a more structured and explicit approach based on teaching phonics. Such is the force of this debate that a number of English-speaking countries have carried out extensive investigations and enquiries into what constitutes best practice. Examples of such enquiries include: *Let's All Read: Report of the Education and Science Committee on the inquiry into the teaching of reading in New Zealand*, Forty-Sixth Parliament, August 2001, *Teaching Children to Read: House of Commons Education and Skills Committee*, House of Commons, 2005 and *Teaching Children to Read*, National Reading Panel, 2000. Recently, the Australian Federal Government established a national enquiry into the teaching of literacy, in part, as a result of concerns about the effectiveness of current approaches.

While acknowledging the place of whole language, significant is that all the aforementioned published reports argue for an increased emphasis on phonics. The US study, *Teaching Children to Read*, is especially significant as, after undertaking an exhaustive meta-analysis of the research associated with beginning reading, concludes that a balanced program should include the essential elements of phonics teaching, in particular, phonemic awareness and phonics instruction.

Currently accepted best practice in reading enshrines the results of the National Reading Panel: *Teaching Children to Read* (2000). The National Reading Panel was initiated by the US Congress in 1997 to allow the National Institutes of Health (NIH) to collaborate with the

⁹⁰ For a list of publications, see <http://www.rmit.edu.au/departments/ps/staffpgs/hempens.htm#Recent%20publications%20and%20presentations:>

Department of Education. Their brief was to create a Panel charged with identifying research-based evidence on how best to teach children to read, and on the effectiveness of various approaches to teaching reading. For its review, the Panel selected research from the approximately 100,000 reading research studies that have been published since 1966, and another 15,000 that had been published before that time. In a very detailed 500-page document, the National Reading Panel highlights the following as crucially important aspects for successful reading:

- Alphabetics, phonemic awareness & phonics instruction,
- Fluency training,
- Comprehension strategies, e.g., metacognitive strategies,
- Teacher education & reading instruction, and
- Computer technology & reading instruction

The full report may be viewed at: <http://www.nichd.nih.gov/publications/nrppubskey.cfm>

The national Reading Panel came out strongly recommending that children learn to read best when taught with an approach that includes explicit instruction in the sounds in words, and by using a systematic approach that teaches a planned sequence of phonics elements, rather than highlighting elements as they happen to appear in text. The Panel determined that effective reading instruction includes the following components:

- Teaching children to break apart and manipulate the sounds in words, often referred to as phonemic awareness,
- Teaching children by using phonics, an approach that explicitly teaches that the sounds in words are represented by letters of the alphabet which can then be blended together to form words,
- Have children practice what they've learned by reading aloud with guidance and feedback, sometimes called guided oral reading, and
- Applying strategies to guide and improve reading comprehension.

How do the proposed Australian curricula emphases reflect the consensus about early reading development and the methods that best promote that development? A simple search through the selected Australian state and territory English documents demonstrates that there is very little, if any mention, of the key words and phrases associated with a phonics approach to teaching reading.

Key Variable: Phonemic awareness

Named in document: California 15 times, Eng 0, NZ 0, WA 1, NSW 1, Vic 0, Tas 0, NT 0, SA 0, QLD 0

Key Variable: Phonics

Named in document: California 11 times, Eng 1, NZ 2, WA 1, NSW 0, Vic 1, Tas 0, NT 1, SA 0, QLD 5 (as graphophonic cues).

Key Variable: fluency

Named in document: California 15 times, Eng 1, NZ 2, WA 1, NSW 1, Vic 0, Tas 0, NT 0, SA 1, QLD 1

Key Variable: explicit

Named in document: California 7 times, Eng 0, NZ 0, WA 1, NSW 0, Vic 0, Tas 0, NT 0, SA 0, QLD 0

Key Variable: systematic

Named in document: California 12 times, Eng 0, NZ 0, WA 0, NSW 0, Vic 0, Tas 0, NT 0, SA 0, QLD 0

Based on the above, and an analysis of the curriculum documents that follows, it is obvious that the Californian document more closely reflects what the research suggests is needed if children are to be taught to read in an effective and timely manner. The Australian documents have been created with little attention to the literacy research findings of the last 20 years; such as that represented by the National Reading Panel. Instead, the Australian documents ignore the lower level processes in preference for simply “getting the words off the page”, assuming that learning to read will occur as naturally and spontaneously as learning to speak. In contrast to the Californian document, the Australian and the New Zealand documents focus on “multiple literacies”, a conception in which pictures, computer icons, signs, and television images are considered equally valuable sources of literacy information. Unfortunately, this tends to direct attention away from the low level alphabetic difficulty that plagues 90% of struggling readers.

The proposed Australian and New Zealand curricula remain dominated by the whole language model of the 1980's. Some of the implied assumptions in the documents that are incongruent with research findings include the view:

- that learning to read is as natural as learning to speak,
- that all children can learn to read simply by being read to, and immersed in good books,
- that directly teaching children to read is unproductive,
- that good readers don't attend to each word they read, but rather guess at a word's pronunciation, based largely on non-alphabetic cues,
- that direct phonics teaching is unnecessary or harmful,
- that there is no accurate interpretation of an author's message, only unique idiosyncratic interpretations derived from each person's differing life experiences, and
- that correction of errors is harmful.

England

The English document divides reading skills into four areas: reading strategies, word recognition and graphic knowledge, grammatical awareness and contextual understanding. As such, there is a balanced approach between whole language, where students are asked to work out the “meaning derived from the text as a whole” and “draw on their background knowledge and understanding” and phonics, as evidenced by the requirement that children “hear, identify, segment and blend phonemes in words” and “recognize that the same sounds may have different spellings and that the same spellings may relate to different sounds”. Of interest, is that the House of Commons enquiry into the National Literacy Strategy has recommended an even greater emphasis on phonics teaching and an investigation into the usefulness of synthetic phonics as a result of the Scottish based Clackmannanshire research project.

New Zealand

In the early years of reading, the New Zealand document, under Personal Reading, states that

children should, “select and read for enjoyment and information a range of written texts, beginning to use semantic, syntactic, visual and grapho-phonetic cues to gain meaning”. The statement fails to detail the nature of such cues or to differentiate their relative importance in the reading process. Once again the focus is on strategies associated with whole language, for example, “the Teacher draws on students’ prior knowledge and experiences as an introduction to the text” and “The teacher draws attention to significant visual cues, and draws on other material to help students’ understanding”. While the New Zealand approach to the early years of reading, as evidenced by the ‘reading recovery’ approach has had a significant impact in Australia and the US, of interest is that the *Report of the Education and Science Committee on the inquiry into the teaching of reading in New Zealand* (2001) recommended an increased emphasis on phonics. The report recommends that, “a re-emphasis must be made on the importance of the development of phonetic, word-level decoding skills in a balanced teaching of reading programme” and that “the ministry of education provide advice and support to schools to incorporate successful phonics programmes into the classroom”.

California

The Californian documents, when compared to the other documents being examined, present a very detailed and comprehensive treatment of a phonics approach to the early years of reading. Teachers are given clear instructions of what children are to learn and there is an expectation that particular skills are mastered on a year-by-year basis. In the *English-Language Arts Content Standards for California Public Schools* document, at grade one, under the heading ‘Word Analysis, Fluency, and Systematic Vocabulary Development’, children are asked to “select letter patterns and know how to translate them into spoken language by using phonics, syllabication, and word parts”. Under the sub-headings of ‘Phonemic Awareness’ and ‘Decoding and Word Recognition’ there are detailed examples of the skills children are expected to master, for example, “Distinguish initial, medial and final sounds in single-syllable words” and “generate the sounds from all the letters and letter patterns, including consonant blends and long and short-vowel patterns (ie, phonograms) and blend those sounds into recognizable words”. The second document, entitled *Reading/Language Arts Framework for California Public Schools*, presents a persuasive rationale in support of phonics instruction, including the results of research and an explanation of the importance of phonics related skills such as ‘decoding’ (decoding is essential to reading unfamiliar words and reading words independently and is a critical benchmark in a student’s reading development) and ‘automaticity’ (A primary reason for its importance is that if students are not fluent, automatic decoders, they will spend so much mental energy decoding words that they will have too little energy left for comprehension). It should be noted that the Californian documents, in addition to stressing phonics, also value the importance of reading comprehension strategies such as, “generating and responding to essential questions, making predictions, comparing information from several sources”. In particular, similar to a whole language approach, children are asked to, “use context to resolve ambiguities about word and sentence meanings” and “relate prior knowledge to textual information”.

Victoria

The *Victorian Essential Learnings Standards* document gives priority to a whole language approach to the early years of reading. Statements such as, “Students learn that print text maintains a constant message, and they use title, illustrations and knowledge of a text topic to predict meaning in texts” ignore phonics and phonemic awareness in preference for children using non-phonetic reading strategies. While there is some recognition of the importance of

phonics, as with the statements, “To make meaning they use context and information about words, letters, combinations of letters and the sounds associated with them, and when reading aloud they use illustrations to extend meaning” and “They recognise how sounds are represented alphabetically and identify some sound-letter relationships”, compared to the English and Californian documents, the coverage is minimal and there is little specific direction to teachers as to what the key phonic skills are and when they should be introduced.

Western Australia

The documents analysed include the *Curriculum Framework: English Learning Area Statement* and the *Curriculum Framework Curriculum Guide English (K-12) Draft*. The *Curriculum Framework* document nods in the direction of phonics with such statements as, “Students read actively, using background knowledge, personal experience and experience of other texts, as well as knowledge of language such as sound-symbol relationships and cueing systems, to make meaning of texts”, but there is very little, if any, specific information detailing essential phonic skills. Statements like, “They use a range of different reading strategies, varying these strategies according to their purpose of reading and the nature of the text”, begs the question as to what the strategies are being referred to and when they might be best introduced or dealt with. The Western Australian document, with statements like, “Students respond to their reading critically. They examine how information, experience or ideas are presented and the way language is used in a text, and consider how this may influence responses to the text. They identify values and assumptions within a text and the ways in which a text may seek to elicit particular responses from readers. They discuss the possibility of varying interpretations of and responses to texts and reflect on how their context and values influence reading” give precedence to a critical literacy approach to reading in preference to phonics. The second document, entitled “*Curriculum Framework Curriculum Guide English (K-12) Draft*”, when detailing the focus of learning, uses such statements as, “developing reading fluency”, and “strategies for identifying words and comprehending words”. Teachers are not given any detail as to what such statements are actually referring to or guidance as to how they are to be translated into classroom practice. Under the heading, ‘Word Conventions’, there is some recognition of the importance of phonics, with the statement that learning to read should include, “phonological awareness” and “graphophonics”, but the treatment is sparse and most of the recommended strategies have more in common with the whole language approach.

New South Wales

The *English K-6 Syllabus* incorporates elements of both a whole language and phonics approach to beginning reading. On one hand, statements such as “uses the illustration on the cover of the book to make predictions about what the story is going to be about when reading” and “uses picture clues to predict a text’s content and makes connections between illustrations and written text when reading” are in line with the whole language approach of using non-phonemic strategies to gain meaning from a text. On the other hand, the NSW document, under the heading ‘Graphological and Phonological Information’ gives teachers detailed guidance as to the types of skills needed related to phonics. Examples at Early Stage One include, “hears and articulates sound segments in words”, “identifies some letters or sounds beyond those in own name”, “recognises most sounds of the alphabet”, “hears a sequence of sounds and blends single sounds in vowel–consonant (vc), consonant–vowel (cv) and consonant–vowel–consonant (cvc) words” and “segments words into onset and rime (eg ‘strip’ – ‘str’ and ‘ip’), syllables etc”. Further details related to the importance of phonics are provided under the headings, ‘Sound Awareness’ and ‘Letter-Sound Relationships’.

Tasmania

Tasmania's approach to curriculum development is based on defining what are termed essential learnings outcomes and standards; reading is dealt with under the heading *Communication*. Compared to the Californian, English and NSW documents, there is a greater focus on critical literacy and whole language as opposed to phonics. Examples of a critical literacy focus include, "critically analyse and transform texts: understanding and acting on the knowledge that texts are not neutral" and "discuss non-literal meanings in texts, including recognizing and critiquing stereotypes and generalisations". There appears little, if any, guidance in relation phonics or phonemic awareness and statements like, "understand how to comprehend and create meaningful spoken, written and visual texts, using appropriate symbolic, cultural, syntactic and semantic understandings" fail to detail what such 'understandings' refer to or to give teachers explicit guidance on how such 'understandings' might be implemented in the classroom.

Queensland

The Queensland document analysed is entitled *English Years 1 to 10 Syllabus*. Under the heading, Level 1 Reading and Viewing – Core Learning Outcomes (Operational Strand Using Language Systems), students are asked to, "predict and confirm by using prior knowledge, supportive visuals and semantic, syntactic and graphophonic cues" does nothing to detail what such strategies refer to and appears to treat all as equally important. While many of the statements provide a clear and succinct description of the strategies needed to understand syntax and sentence structure, there is minimal treatment of phonic and phonemic awareness. Statements such as, "names and commonly(sic) associated of consonants and short vowels (graphophonic cues) in words", "visual letter patterns and rimes, two-letter consonant blends (graphophonic cues) found in words in familiar texts' and "graphophonic cues including long vowels and digraphs, consonant blends and digraphs, visual letter patterns", while nodding in the direction of phonics and phonemic awareness, there is little, if any, guidance making such strategies more explicit or detailed.

Northern Territory

Under the heading, 'Reading and Viewing', curriculum statements like "recognise and interpret basic language structures and features of texts" and "use a range of basic strategies to select and interpret visual and short written texts" are somewhat general in nature and fail to give teachers explicit guidance. While further details are provided, under the heading 'Indicators – Language Structures and Features', there is still the concern that such statements are open to interpretation. For example, "identify letter names and a variety of sounds they may produce" and "recognise some letter combinations and sounds in words" fail to clarify which sounds and which letter combinations are needed for successful reading. Some statements, such as "make meaning in visual and written texts using simple methods, eg draw on experience or background knowledge of the topic or context, make connections between illustrations and written text", are based on a whole language approach and, when compared to the Californian and English documents, treatment of phonics and phonemic awareness is brief and superficial.

South Australia

The two South Australian documents analysed are, the *SACSA Framework English* and the *SACSA Companion Document Series R-7 English Teaching Resource*. As with the other Australian documents, the SACSA documents give teachers general curriculum outcome statements that are then further detailed with examples and indicators. Once again, under the Strand Strategies, statements such as, "interprets meaning (eg uses visual cues to work out

unknown words; predicts content using cover information, illustrations and text; scans text” reflect a whole language approach to reading. Within the *Companion Document Series R-7 English Teaching Resource* there is some treatment of phonics, as illustrated by descriptors such as “Begins to develop phonological awareness” and “Recognises letters of the alphabet and uses their sounds to attempt to sound new words”, but, such treatment is sketchy and superficial. Statements such as “Uses initial letters, pictures and content knowledge as cues” and “Uses titles, illustrations and prior knowledge of the topic to predict meaning and content” reflect a whole language approach.

Examples of strong and weak descriptors

Examples of descriptors

Area covered	Strong	Weak
Technical aspects of literature	<p>“Students in the fourth grade will continue to learn about fundamental elements of literature that will allow them to appreciate the rich quality and complexity of materials they read. The elements include describing the structural differences between fables, myths, fantasies, legends, and fairy tales as well as defining and identifying simile, metaphor, hyperbole, and personification in literary works”. (Grade 4) <i>California Reading Language/Arts Framework</i></p>	<p>“select and read independently, for enjoyment and information, different contemporary and historical texts, integrating reading processes with ease” (L3) <i>New Zealand English in the New Zealand Curriculum</i></p> <p>Reads independently an extensive range of texts with increasing content demands and responds to themes and issues. RS3.5 NSW <i>English K-6 Syllabus</i></p>
Technical aspects of literature	<p>Define how tone or meaning is conveyed in poetry through word choice, figurative language, sentence structure, line length, punctuation, rhythm, repetition, and rhyme. (Grade 3) <i>California English Language/Arts Content Standards</i></p>	<p>Discusses the text structure of a range of text types and the grammatical features that are characteristic of those text types. (Stage 2) NSW <i>Defining Mandatory Outcomes in the K-6 Curriculum</i></p> <p>Understands how to use basic structures, features and strategies to communicate in a variety of contexts for a range of purposes. Standard 2, Communicating Being Literate. <i>Tasmania Essential Learnings</i>.</p>

<p>Early years of reading</p>	<p><i>Decoding and Word Recognition</i></p> <p>1.10 generate the sounds from all the letters and letter patterns, including consonant blends and long- and short-vowel patterns (i.e., phonograms), and blend those sounds into recognizable words.</p> <p>1.11 Read common, irregular sight words (e.g., <i>the, have, said, come, give, of</i>).</p> <p>1.12 Use knowledge of vowel digraphs and <i>r</i>-controlled letter-sound associations to read words.</p> <p>1.13 Read compound words and contractions.</p> <p>1.14 Read inflectional forms (e.g., <i>-s, -ed, -ing</i>) and root words (e.g., <i>look, looked, looking</i>).</p> <p>1.15 Read common word families (e.g., <i>-ite, -ate</i>).</p> <p>1.16 Read aloud with fluency in a manner that sounds like natural speech.</p> <p><i>California, Grade 1 Reading</i></p>	<p>select and read for enjoyment and information a range of written texts, beginning to use semantic, syntactic, visual, and grapho- phonic cues to gain meaning.</p> <p><i>New Zealand, Level 1</i></p>
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<p>Early years of reading</p>	<p>Graphological and Phonological Information</p> <ul style="list-style-type: none"> • distinguishes print from drawings • shows an awareness of the horizontal nature of print in English and left to right direction • recognises and supplies rhymes • recognises spoken words with same sound or given sound • recognises that words are made up of letters • hears and articulates sound segments in words • identifies some letters or sounds beyond those in own name • recognises most sounds of the alphabet • hears a sequence of sounds and blends single sounds in vowel–consonant (vc), consonant–vowel (cv) and consonant–vowel–consonant (cvc) words • segments words into onset and rime (eg ‘strip’ – ‘str’ and ‘ip’), syllables etc • recognises sight words in printed texts • identifies full stops and capital letters in printed texts. <p><i>NSW, Reading Early Stage 1</i></p>	<p>Language Structures and Features</p> <ul style="list-style-type: none"> • identify and explain some organizational features of written texts, eg purpose of headings, diagrams and contents page, recognise that some words join sentences [Sci-WS] [LT-R] • identify letter names and a variety of sounds they may produce • recognise some letter combinations and sounds in words • recognise and use known sight words automatically in different contexts [LT-P] • locate information from simple visual organisers, eg story map, graphic outline [LT-R] • recognise relationships in written sentences through use of conjunctions, eg ‘because’, ‘and’, ‘but’ • make meaning using noun-pronoun (cat-It) and subject-verb (cat chases) links across simple and compound sentences when reading, eg ‘The cat has fur. It chases mice’. <p><i>Northern Territory, Band 1</i></p>
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9. Recommendations for strengthening state and territory intended curriculum

Since the development of the national statements and profiles during the early to mid 1990s, Australian state and territories have adopted various versions of OBE. Currently, states and territories are going through a renewed round of curriculum development that, while acknowledging a number of weaknesses evident in OBE, still embodies many of the characteristics of this approach to curriculum development. As noted in this report (in particular, see sections 7.1, 7.2, 8, 8.1, 8.2, 8.3), OBE and associated intended curriculum documents have a number of flaws and weaknesses when compared to either a syllabus or a standards approach. It is also the case that those countries that consistently achieve the strongest results in TIMSS and TIMSS-R adopt a syllabus approach to curriculum development (see sections 5 and 6 of this report).

It is recommended that state and territories no longer adopt an OBE approach to curriculum development and, instead, adopt a syllabus model. Related to this is the need to:

- relate intended curriculum to year levels,
- reduce the emphasis on formative assessment in preference for summative assessment,
- reduce the emphasis on constructivism in preference for direct instruction and more formal teaching strategies, and
- ensure that curriculum descriptors, in the light of the results of the comparative analysis (contained in the accompanying report: *Where Do We Stand: Intended Curriculum Analysis*) are more detailed, unambiguous, measurable and based on essential learning as represented by the subject disciplines.

To assist in the above, consideration should be given to developing Australia wide syllabus documents, initially, in the areas of primary school mathematics, science and English. Such syllabuses would provide teachers with a clear and succinct road map of the essential learning required related to year levels. Such documents would acknowledge the various state and territory intended curriculum outcomes as well as international research and best practice.

A further recommendation is that state and territory intended curriculum documents are regularly benchmarked against international best practice and that the results of such research are made public. Given that this benchmarking project related to the primary level, it is also recommended that there be a benchmarking analysis of Australian state and territory secondary school intended curriculum in mathematics, science and English.

9.1 Mathematics recommendations

There is a strong argument for developing a mathematics syllabus that could be accessed by all schools in Australia. There is also an argument for a nation-wide evaluation of the performance standards linked to the syllabus using a model similar to that used in Japan where large samples of the student population are tested, not on the achievement of minimum expected standards, but on middle and higher level thinking aligned with national curriculum standards. The goal here is report on how well the curriculum is being implemented – where are students achieving well, where are students finding difficulty, which areas of the curriculum appear to be well covered and which need to be given more attention.

In countries like Japan and Singapore, syllabus documents leave no doubt about what needs to be taught at each year level, and what children are expected to understand and be able to

do. Teachers are free to experiment with sequencing. But, in the main, teachers are expected to devote their energies to improving teaching and hence the quality of student learning. This task is for all teachers in a school - from the newest teacher to the school principal. Mentoring programs are provided for young teachers. Collaborative “lesson study” programs are conducted in each primary school where all teachers work together to refine lessons and to foster high quality learning within and across subject boundaries.

9.2 Science recommendations

Australian primary science curriculum documents generally cover the same content areas that deal with the main ideas found traditionally in Chemistry, Physics, Biology and Earth and Space Science, albeit with different headings. The documents are relatively new and have attempted to reduce the large numbers of learning outcomes that prevailed several years ago. There has been an effort to ensure that teachers revisit topics and sequentially develop the science ideas within these areas. Most documents have tried to cater for both the needs and interests of students and to make the science ideas explicit and related to the students’ lived experiences of the world. The documents do not lean towards the rote learning of facts, but rather the understanding of the science principles involved and the interrelated nature of the sciences. In essence, the documents are similar, modern and based on conceptual understandings of science.

The science content, the introduction of the science content and its sequencing is remarkably similar throughout the states and territories.

There are a few weaknesses in the curriculum documents that require some consideration because the weaknesses that do prevail are significant in their potential to impact on the eventual quality related to science teaching. The Australian curriculum documents in most states and territories do not provide a year level focus, but have an outline that provides for coverage that can take up two to three years. This does not ensure that the coverage of the science content is visited regularly and consistently. The concern should be that the teaching of this science content could possibly be avoided for a year, even two years, because it is not stated that it is a required year level component of the intended curriculum.

It is rare to find a statement that either designates or suggests a recommended time allotment for teaching science in primary schools. This lack of guidance is a concern. Schools do need to be flexible and able to respond to students’ needs and interests, but against a structure of a suggested curriculum that can guide the choices and balance of the science content. It would be helpful if teachers had a guide for the time that could be anticipated for adequate coverage of the science content; teachers would then be in a better position to plan appropriate units and lessons.

The states and territories have created a large number of supportive resource materials. These support materials are available to teachers on-line to support their planning for the teaching of science and do suggest ways that science can be successfully taught in classrooms. Given the already large and detailed curriculum guidelines combined with the extensive resource materials, the danger is that teachers are overwhelmed by this detail. Teachers have the capacity to provide good teaching, yet often lack the time needed to plan, organize and implement curriculum. One of the benefits of a syllabus approach, as teachers do not have to design their own syllabuses, is that more time is given to strengthening classroom pedagogy.

Primary science has been frequently integrated into other subject areas and students are rarely tested (Status and Quality of Teaching and Learning of Science in Australian Schools 2001). The integration of science into other areas as appropriate may strengthen or weaken the science being taught depending on the teacher's ability. Lack of testing and regular assessment in primary science may indicate a lack of clarity about the science being taught and thus to be assessed or the prevailing influence of formative assessment.

Student progress in science is often not reported to parents (Status and Quality of Teaching and Learning of Science in Australian Schools 2001⁹¹). This may reflect the lack of clarity and focus that maybe occurring in the teaching of science but contrasts with the value and expectations of parents who rate science as third in importance after literacy and numeracy in the school curriculum.

45 % of Australian primary teachers have stated that they would prefer to change careers (Status and Quality of Teaching and Learning of Science in Australian Schools 2001). Teachers are struggling to maintain a positive self-image and have high levels of stress due to lack of time, resources and professional development opportunities (Ibid). Teachers need to be valued and supported for their efforts, many primary teachers admit to experiencing difficulties and a lack of confidence with the content of science (Ibid p 172)

A strength that has been identified in the curriculum documents being used in Singapore and England is the focus and provision of the year by year sequencing guide for areas to be covered instead of levels incorporating two to three years as appears in many Australian documents. Although England provides a focus to be covered in two or three years it also details and requires certain targets to be aimed for each year.

Given the expectation in the English and the Singapore approaches that science is taught on a yearly basis, there is a greater chance that teachers address science learning on a more regular and consistent basis, when compared to the Australian approach. The provision of a time requirement for teaching science in primary schools is likely to ensure more regular coverage of the content.

The Singapore document has the ability to convey the required science content concisely, while at the same time highlighting what teachers need to focus on as essential. The curriculum has developed depth in its content, rather than breadth, and this is evident in the year by year guide that allows the teacher to stay clearly focused on their goals.

Major science recommendations

Australian Science Curriculum documents that are available to primary schools would benefit from ensuring that:

1. there is a syllabus that helps teachers to develop a yearly sequence of science curriculum learning outcomes, and
2. there is a recommended allocation of time for regular science teaching.

⁹¹ As a result of Australian Government legislation, it is envisaged that student progress in science will be reported as from 2006.

Supporting science recommendations⁹²

Greater attention also needs to be given to:

1. support for all primary teachers to participate in science professional development programs that build science understanding, awareness of the issues in science teaching and provides time to reflect on and plan quality science teaching experiences,
2. incorporation of student designed investigations and projects that promote thinking skills and student discussion, while responding and including students' questions, needs and interests, and
3. allocation of teaching assistants who supply and maintain the science, mathematics and technology equipment in primary schools.

9.3 English recommendations

The comparative analysis of intended curriculum documents demonstrated, in the areas of literature and early years of reading, that the Australian documents are not as rigorous or sound as the Californian and the English examples. The recommendation is that an English syllabus be developed with particular attention to strengthening the areas of literature and early years of reading. In relation to literature, the recommendations are that:

- a national English syllabus be developed, based on year levels and including, but not restricted to, essential knowledge, understanding and skills related to literature as a subject,
- less emphasis be placed on critical literacy and greater emphasis on a cultural literacy model of literature,
- primary school children be given a rich and varied array of myths, fables and legends that deal with significant human emotions and predicaments,
- a study of literature, in a manner appropriate to primary school students, also include the more technical aspects of literary appreciation, including metre, rhythm and rhyme and the use of similes and metaphors associated with figurative language use, and
- consideration be given to developing sets of Australian Readers⁹³, similar to those developed under the Discovering Democracy program, but with a literary focus. Such Readers would provide a rich and varied selection of myths, legends and fables that would provide a common currency of morals and ethical values for Australian children to encounter.

In relation to the early years of reading, the Australian documents also fare badly when compared to the overseas intended curriculum documents. In relation to the early years of reading, the recommendations are that⁹⁴:

- a national English syllabus be developed, based on year levels and including, but not restricted to, essential knowledge, understanding and skills related to the early years of

⁹² The supporting recommendations, while not based on the intended curriculum analysis as such, reflect the author's view of what needs to be done to strengthen science teaching in primary schools.

⁹³ The Australian Readers, published as part of the federally funded Discovering Democracy Program, received consistent praise from schools and teachers and, according to the Curriculum Corporation, are the most regularly re-ordered part of the programme.

⁹⁴ The following should be considered in the light of the recommendations arising out of the National Inquiry into the Teaching of Literacy.

reading,

- less emphasis be placed on the whole language approach and greater emphasis on phonics,
- resources be provided for teacher professional development, based on sound research as to the most effective way to teach literacy, and
- teacher training in the area of early years of literacy being examined to ensure prospective teachers are adequately trained.

APPENDIX A

DEFINITIONS

Achievement	The US New Standards Project uses the term 'performance levels' when discussing achievement. 'Performance levels' are defined as the levels of performance that constitute mastery of standards. The National Assessment Governing Board publication <i>NAEP Civics</i> (1998), uses the term 'Achievement Level Descriptions' which are to indicate "... how well students should perform on the knowledge and skills measured by the assessment" (p xii). The English National Curriculum uses the term 'Attainment Targets' when discussing "expected standards of pupils' performance"; these are described as: "the types and range of performance that pupils working at a particular level should characteristically demonstrate". The NAEP document (1998) also defines achievement at a particular grade level as 'basic', 'proficient' and 'advanced'.
Basic academic skills	Refers to those skills in subject areas, including, but not limited to, reading, spelling, written expression, and mathematics that provide the necessary foundation for mastery of more complex intellectual abilities, including the synthesis and application of knowledge.
Content standards	Content standards were designed to encourage the highest achievement of every student, by defining the knowledge, concepts, and skills that students should acquire at each grade level. California State Board of Education
Constructivism - Constructivist	The South Australian SACS Overview document states: "The framework is based on constructivist theories of learning which view the learner as active in the process of taking in information and building knowledge and understanding; in other words, of constructing their own learning."
Developmental	The belief that learning occurs at different rates and in different ways for students. For example, the WA <i>Curriculum Framework</i> (p 29) states: "It is recognised that each student is developing and achieving in different ways, at different stages and at different rates". The Northern Territory Curriculum Framework states: "Learning is a lifelong journey in which all learners develop at their own pace as they progress via many different pathways. Development patterns follow a broad continuum that builds on demonstrated knowledge and understandings" <i>NT Curriculum Framework – Overview</i> , p 1.

Essential learnings	<p>Australian state and territories such as Tasmania, South Australia, Queensland and the Northern Territory adopt an approach to curriculum centred on the concept of essential learnings. The South Australian introduction to essential learnings describes essential learnings as: “understandings, dispositions and capabilities which are developed through the Learning Areas and form an integral part of children’s and students’ learning from birth to Year 12 and beyond. They are resources which are drawn upon throughout life and enable people to productively engage with changing times as thoughtful, active, responsive and committed local, national and global citizens. Engaging with these concepts is crucial to enhancing the learning culture within and beyond schools/sites”. This approach adopts a child-centred, constructivist and developmental approach and, when compared to a syllabus or a standards approach, focuses less on subject content and more on attitudes and dispositions.</p>
Framework	<p>Curriculum documents, generally speaking, can be described as syllabuses, frameworks or standards. Frameworks adopt an outcomes approach to curriculum by detailing what students will or should be able to do a particular key stage; often expressed as a developmental continuum across a range of age groups or year levels. Frameworks are generally flexible and give room for school-based curriculum decision making. The Western Australian <i>Curriculum Framework</i> document (1998, p 6) describes itself as: “It is neither a curriculum nor a syllabus, but a framework identifying common learning outcomes for all students...”</p>

Indicators	The NSW English K-6 Syllabus defines indicators as a statement of the behaviour that students might display as they work towards achievement of outcomes and are to be considered as examples. The NT curriculum defines indicators as providing “the curriculum scope for planning and/or assessing learning. They illustrate ‘what learners might do’ to demonstrate progress towards the achievement of the outcome, thus enabling judgments to be made about learners’ progress. They are NOT criteria and should not be used as a checklist. Indicators appropriate to local context can be added to enrich the evidence of learners demonstrating a particular outcome” (DEET undated p 6).
Moderation	Moderation is the process of achieving comparable standards across the system and typically involves the qualitative comparison of student work and a statistical procedure such as standardising to a given mean and standard deviation. Australian Curriculum, Assessment and Certification Authorities (ACACA)
Outcomes	What Australians term 'outcomes', American educators call 'standards'. Both focus on what students should know and be able to do at particular stages of their schooling. The Victorian CSF outcomes detail what "students will be able to do" at the completion of particular levels. The NSW definition is that "outcomes are statements of the knowledge, understanding and skills expected to be gained by most students ... by the end of a stage". Within the US context, the term 'outcomes' is sometimes used pejoratively as signifying vague and overly generalised curriculum statements restricted to attitudes, dispositions and sentiments (see Manno, 1994).
Performance standards	These are the standards that define various levels of competence at each grade level in each of the curriculum areas for which content standards are established. Performance standards gauge the degree to which a student has met the content standards and the degree to which a school or school district has met the content standards. California Academic Standards Commission
Performance descriptions	The New Standards <i>Performance Standards</i> describes these as: "descriptions of what students should know and the ways they should demonstrate the knowledge and skills they have acquired in the four areas assessed by the New Standards". New Standards <i>Performance Standards</i> . Introduction.

Standards	<p>Different education systems interpret the term 'standards' in different ways. The US New Standards Project defines 'standards' as: “what students should know and be able to do”. This definition is also used by the American Federation of Teachers (see AFT, 1999). Victoria's CSF, on the other hand, uses ‘standards’, as a synonym for ‘learning outcomes’, which are described as: “benchmarks or standards against which student achievement can be measured”. Within the US context standards refer to core knowledge, understanding and skills. A distinction is made between ‘content standards’ – what students should know and be able to do – and performance standards – achievement levels that specify what depth of knowledge, understanding and skills is considered good enough. The curriculum developed by the California State Board of Education further details standards in the following way “The standards are mastery standards, meaning that students should master or be proficient in the knowledge, skills and strategies specified in a particular standard, at least by the end of the designated grade”. California State Board (1999) p 6.</p> <p><i>WA SACSA An Overview</i> describes standards as: “the expectations we have of learners. They provide a common reference point for educators to use in monitoring, judging and reporting on learner achievement over time” p 5. Standards, when used to describe the required level of learning, should not be confused with the US developed standards movement which describes the preferred model of curriculum development that has replaced OBE.</p>
Syllabus	<p>Curriculum documents can be described as adopting a syllabus, a frameworks or a standards approach. Syllabuses detail the knowledge, understanding and skills associated with particular subjects and give teachers and students a clear and succinct understanding of what is to be taught. The Japanese, Singapore and English National Curricula adopt a syllabus approach. Syllabuses are often mandated, as is the English curriculum, involve high risk, summative assessment, as shown by the testing regime in Singapore and address specific year levels.</p>
Scaling	<p>Inter-subject scaling is a process used to ensure comparability of results across subjects. In relation to Australia, McGaw (1996) writes: "... attention was given early to the problems of aggregating normative marks, where it was easier to gain high marks against easier competition in some subjects and courses. The solution involved adjusting the marks in each course on the basis of a measure of the general strength of the candidates in the course". This was achieved either by using the Australian Scholastic Aptitude Test or by measuring the students' average performances in their other courses. There are other forms of scaling including inter-marker scaling to adjust for differences in marker toughness and inter-year scaling to adjust for differences in the difficulty of assessment tasks between years.</p>

Organisations and individuals identified:

Achieve.org <http://www.achieve.org/achieve.nsf/Home?OpenForm>

American Federation of Teachers <http://www.aft.org/>

APEC Education Network <http://www.apec.edu.tw/111.html>

Australian Capital Territory Department of Education and Training
<http://www.decs.act.gov.au/>

Australian Council for educational Research <http://www.acer.edu.au/>

Australian Department of Education, Science and Training <http://www.dest.gov.au/>

Australian Mathematical Sciences Institute <http://www.amsi.org.au/>

Board of International Comparative Studies in Education
<http://www7.nationalacademies.org/bicse/index.html>

Boston College's TIMSS and PIRLS International Study Centre <http://timss.bc.edu/>,

Hudson Institute <http://www.hudson.org/>

International Association for the Evaluation of Educational Achievement <http://www.iea.nl/>,

Korea Institute of Curriculum and Evaluation (2003), 'A Study for the Improvement of the National Curriculum Revision System, <http://www.kice.re.kr/english/eindex.htm>

Thomas B. Fordham Institute <http://www.edexcellence.net/institute/global/index.cfm>

International Review of Curriculum and Assessment Frameworks
<http://www.inca.org.uk/index.asp>

National Association of State Boards of Education <http://www.nasbe.org/>

National Centre for Educational Statistics <http://nces.ed.gov/>

National Foundation for Educational Research <http://www.nfer.ac.uk/index.cfm>

New South Wales Board of Studies <http://www.boardofstudies.nsw.edu.au/>

New Standards Project <http://www.ncrel.org/sdrs/areas/issues/methods/assment/as7nsp.htm>.

New Zealand Education Review Office <http://www.ero.govt.nz/>

New Zealand Ministry of Education <http://www.minedu.govt.nz/>

Northern Territory Department of Employment, Education and Training
<http://www.deet.nt.gov.au/education/index.shtml>

OECD Directorate for education
http://www.oecd.org/department/0,2688,en_2649_33723_1_1_1_1_1,00.html

Office for Standards in Education <http://www.ofsted.gov.uk/>

Queensland Studies Authority <http://www.qsa.qld.edu.au/index.html>

South Australia Department of Education and Children's Services
http://www.schools.sa.gov.au/schl_home.asp

South Australian Curriculum Standards and Accountability Framework
<http://www.sacsa.sa.edu.au/splash.asp>

Tasmanian Department of Education <http://www2.education.tas.gov.au/>

UNESCO Education http://portal.unesco.org/education/en/ev.php-URL_ID=15200&URL_DO=DO_TOPIC&URL_SECTION=201.html

United States Department of Education <http://www.ed.gov/index.jhtml>

Victorian Curriculum and Assessment Authority <http://www.vcaa.vic.edu.au/>

Western Australian Curriculum Council <http://www.curriculum.wa.edu.au/>

Summary of Jonathan Jansen's criticisms of South Africa's adoption of OBE.

Taken from: *Curriculum 2005, Outcomes-Based Education, and the South African Schools Act*. Independent Projects Trust <http://www.ipt.co.za/SAM.asp>

Jonathan Jansen, of the Macro-Education Policy Unit at the University of Durban Westville, recently submitted a paper titled, "Why OBE will fail." A summary of his ten points follows:

1. The language and concepts associated with the new curriculum (particularly with OBE) is too complex, confusing and often contradictory. The maze of jargon and tortured definitions are simply inaccessible for most teachers to give these policies meaning through their classroom practices.
2. What official documents claim about the relationship between curriculum and society, especially OBE's assumed impact on economics, is unfounded and misleading. It is such an over-sell that is not only misguides and misinforms teachers and the public, but it also undermines the authenticity of the policy itself.
3. OBE policy is based on flawed assumptions about what happens inside the average South African classroom. It requires the development of skills, theoretical understanding and capacity to transfer the policy across different contexts. Without intervention at the classroom-level, OBE can only become a mechanical model of behaviourism in the majority of South African classrooms.
4. There are strong philosophical arguments questioning the desirability of OBE in democratic school systems. OBE policy offers an instrumentalist view of knowledge which violates the structure of certain subjects. There is also an inherent contradiction in insisting that students use knowledge creatively only to inform them that the desired learning outcomes are already specified.
5. There is something fundamentally questionable about a focus on the ends, when much of the educational and political struggle of the 1980s valued the processes of learning and teaching as ends in themselves. This problem extends to the manner in which teachers as a constituency have been limited in their participation around this important policy.
6. OBE, with its focus on instrumentalism, enables policy makers to avoid dealing with a central question in the South African transition viz. what is education for? The learning outcomes barely allude to values and principles - they are bland, decontextualised, global statements which will make very little difference in a society emerging from apartheid and colonialism.
7. The management of OBE will multiply the administrative burdens placed on teachers. Without adequate support such as release time, aide support, smaller class sizes, etc., OBE will fail. With current policies of teacher rationalisation and the subsequent increase in average class sizes, OBE enters an environment which works directly against its success.
8. OBE trivialises curriculum content yet children do not learn outcomes in a vacuum. It also threatens to fragment knowledge by ignoring inter-disciplinary demands encountered in learning a complex task. It further assumes that the way knowledge is acquired is linear.
9. For OBE to succeed even in moderate terms, a number of interdependent education innovations are needed simultaneously:
 - trained and retrained teachers
 - radically new forms of assessment

- classroom organisation which facilitates monitoring and assessment
- additional time for managing this complex process
- constant monitoring and evaluation of the implementation process
- retrained education managers or principals to secure the implementation as required
- parental support and involvement
- new forms of learning resources (textbooks and other aides) consonant with an OBE orientation
- opportunities for teacher dialogue and exchange as they co-learn the process of implementation

There is neither the fiscal base or political will to intervene in the education system at this level of intensity. Yet nothing less is required to give the policy a reasonable chance of success.

10. OBE requires a radical revision of the most potent mechanism in schools militating against curriculum innovation viz., the system of assessment. Without intensive debates about the reorganisation of the assessment system, traditional examinations will reinforce the curriculum status quo.

In his conclusion, Jansen acknowledges that the apartheid curriculum requires radical reconstruction. But he warns that the scale of the problem defies simple solutions and asserts that curriculum innovations must take account of the resource status of schools and classrooms as well as the extensive experiences of other countries with similar initiatives.

BIBLIOGRAPHY

Anderson, JR. Reder, LM and Simon, HA (1998), 'Radial Constructivism and Cognitive Psychology' in D. Ravitch (Ed.) *Brookings papers on education policy 1998*. Washington, DC: Brookings Institute Press. <http://act-r.psy.cmu.edu/publications/pubinfo?id=145>

Anderson, JR. Reder, LM. and Simon, HA. (2000), 'Applications and Misapplications of Cognitive Psychology to Mathematics Education' in *Texas Educational Review*, Summer 2000. <http://act-r.psy.cmu.edu/papers/misapplied.html>

Australian Council for Educational Research (1997), *Maths & Science On the Line: Australian Middle Primary Students' Performance*, ACER, Melbourne.

Australian Council for Educational Research (1999), *Raising Australian Standards in Mathematics and Science: Insights from TIMSS*, ACER, Melbourne.

Australian Council for Educational Research (2004a), *Summing it up: Mathematics achievement in Australian schools in TIMSS 2002*, ACER, Melbourne. http://www.acer.edu.au/research/TIMSS/TIMSS_02_03.htm

Australian Council for Educational Research (2004b), *Examining the Evidence: Science achievement in Australian schools in TIMSS 2002*, ACER, Melbourne. http://www.acer.edu.au/research/TIMSS/TIMSS_02_03.htm

Australian Council for Educational Research (2004c), *Highlights from TIMSS from Australia's Perspective*, ACER, Melbourne, http://www.acer.edu.au/research/TIMSS/TIMSS_02_03.htm

ACT Department of Education and Training (undated), *Studies of Society and Environment Curriculum Framework*, Department of Education and Training, ACT, <http://www.decs.act.gov.au/publicat/acpframeworks.htm>

ACT Department of Education, Youth and Family Services (2004), *Every Chance to Learn: Curriculum Renewal Evaluation Report*, ACT Canberra. http://activated.decs.act.gov.au/learning/curri_renewal.htm

American Federation of Teachers (2000), *Appendix B AFT Criteria for High-Quality Standards*, AFT, USA.

American Federation of Teachers (2003), *Where We Stand: Standards-Based Assessment and Accountability*, AFT. <http://www.aft.org/topics/sbr/index.htm>

Barcan, A (2005), 'The Disputed Curriculum' in *Quadrant*, June 2005, pp 34–45, Balmain, NSW.

Bereiter, C & Kurland, M (1981), *A Constructive Look at Follow Through Results*. Reprinted from *Interchange*, Vol 12, Winter, 1981. <http://darkwing.uoregon.edu/~adiiep/ft/bereiter.htm>

Berlach, R (2004), 'Outcomes-Based Education & the Death of Knowledge' paper given at the Australian Association for Research in Education Conference, the University of

Melbourne, Nov 28-Dec 2, 2004.

Bishop, J (1999), *Are national exit examinations important for educational efficiency?* Swedish Economic Policy Review 6 (1999), pp 349-398.
<http://www.ekradet.konj.se/sepr/vol6.htm>

Blyth, Andrew (2002), 'Outcomes, Standards and Benchmarks' in *Curriculum Perspectives* Vol 22 No 3 September 2002, pp13-22, ACSA, Canberra.

Boston, K (1993), 'Introducing Profiles' in *Curriculum Perspectives* Newsletter Edition June 1993, pp 12-13, ACSA, Canberra.

Boughey, C (undated), *A Brief Guide to Outcomes Based Education and the National Qualifications Framework*, Academic Development Centre, Rhodes University,
http://www.ru.ac.za/academic/adc/obe_print.htm

Bradburn, NM and Gilford, DM, Editors (1990), *A Framework and Principles for International Comparative Studies in Education*, Board on International Comparative Studies in Education, National Research Council, <http://books.nap.edu/html/framework/>

Bruner, J (1960), *The Process of Education*. Harvard University Press. Cambridge.

California State Board of Education (1997) *English-Language Arts Content Standards for California Public Schools*, California State Board of Education, Sacramento,
<http://www.cde.ca.gov/be/st/ss/index.asp>

California State Board of Education (1999) *Reading/Language Arts Framework for California Public Schools*, California State Board of Education, Sacramento,
<http://www.cde.ca.gov/ci/cr/cf/allfwks.asp>

Collins, C (1994), *Curriculum and Pseudo-Science*, Occasional paper No. 2, ACSA, Canberra.

Crittenden, B (1987), *Content with Process in Education: A Place for Cultural Literacy*, School of Education, La Trobe University, Bundoora.

Curriculum Corporation (2000), *World-class Curriculum*, Curriculum Corporation, Melbourne.

Curriculum Council, Western Australia (1998), *Curriculum Framework*, Curriculum Council, Western Australia.

Cuttance, P & Stokes, S (2001) *School Innovation: Pathway to the Knowledge Society*. DEST, Canberra,
http://www.dest.gov.au/sectors/school_education/publications_resources/profiles/school_innovation.htm

Department for Education (2005), *The National Curriculum online*
<http://www.nc.uk.net/webdav/servlet/XRM?Page/@id=6016>

Department of Education and Children's Services (undated), 'Introduction to Essential Learnings and the SACSA Framework', http://www.sacsa.sa.edu.au/index_fsrc.asp?t=EL
Department of Education and the Arts (2005a), *Smarter Learning: The Queensland Curriculum, Assessment and Reporting Framework*, Department of Education and the Arts, Queensland Government, Brisbane. <http://education.qld.gov.au/qcar/>

Department of Education and the Arts (2005b), *Background, rationale and specifications: Queensland Curriculum Assessment and Reporting Framework*, Department of Education and the Arts, Brisbane. <http://education.qld.gov.au/qcar/>

Department of Employment, Education and Training (undated), *Northern Territory Curriculum Framework Overview, EsseNTial Learnings and Learning Area-English documents*, DEET, Darwin, <http://www.deet.nt.gov.au/education/ntcf/index.shtml>

Department of Education and Training (2003), *Time to Teach Time to Lean*, Department of Education and Training NSW, Sydney.

Department of Education Training and Employment (undated), *SACSA An Overview, SACSA Framework English, SACSA Companion Document R-7 English Teaching Resource*, Adelaide, http://www.sacsa.sa.edu.au/index_fsrc.asp?t=HOME

Department of Education Services (2001), *Investing in Government Schools: Putting Children First*, Department of Education Services, Western Australia, Perth.

Department of Education, Science and Training (2004), *Schooling Issues Digest: Performance of Australian School Students in International Studies in Science*, DEST, Canberra.

Department of Training and Education Co-ordination New South Wales. (1997), *Forum on National Statements and Profiles in Australian Schools*, DTEC, Sydney.

Donnelly, K (1998), *Benchmarking the Intended Curriculum: a Comparative Analysis. Final Report*. Prepared for the Victorian Ministry of Education. Melbourne.

Donnelly, K (1999), *An International Comparative Analysis Across Education Systems: Benchmarking the Victorian CSF*. Seminar Series, May, 1999, No 83. IARTV. Melbourne.

Donnelly, K (2002), *A Review of New Zealand's School Curriculum*. Wellington. Education Forum.

Donnelly, K (2004), *Why Our Schools are Failing*, Duffy and Snellgrove, Sydney

Education Review Office (1997), *Literacy in New Zealand Schools: Reading*, Number 5, Winter 1997, Education Review office, Wellington.

Education Review Office (2000), *In Time for the Future: A Comparative Study of Mathematics and Science Education*, Education Review Office, Wellington.

Eltis, K (1995), *Focusing on Learning: Report of the Review of Outcomes and Profiles in NSW Schooling*, NSW Department of Training and Education Co-ordination, Sydney.

Eltis, K (2003), *Time To Teach Time To Learn*, NSW Department of Education and Training, Sydney.

ERIC (1993), *Outcome-based education*, ERIC Digest 85 November 1993, <http://cepm.uoregon.edu/publications/digests/digest085.html>

Farkota, R (2005), 'Basic maths: the brutal reality', On Line Opinion. <http://www.onlineopinion.com.au/view.asp?article=3785>

Fuchs, T and Woessmann, L (2004), *What Accounts for International Differences in Student Performance? A Re-examination Using PISA Data*, IZA Discussion Paper No 1287, September 2004, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=572802

Goodrum, D, Hackling, M and Rennie, L (2001), *The status and quality of teaching and learning of science in Australian schools*. DEST, Canberra. http://www.dest.gov.au/sectors/school_education/publications_resources/profiles/status_and_quality_of_science_schools.htm#authors

Griffin, P (1998), 'Outcomes and Profiles: Changes in Teachers' Assessment Practices' in *Curriculum Perspectives*, pp 9-19, Vol 18, No 1, April 1998, ACSA, Canberra.

Hargreaves, A and Moore S (1999) 'Getting into Outcomes: The Emotions of Interpretation and Implementation' in *Curriculum Perspectives* Vol 19, No 3 September 1999, pp 1-9, ACSA, Canberra.

Hempenstall, K (1999), 'The gulf between educational research and policy: The example of Direct Instruction and whole language' in *Effective School Practices*, 18 (1), pp 15-29, Association for Direct Instruction.s

Hirsch, Jr, ED (1988), *Cultural Literacy*, Random House, New York.

Hirsch, Jr, ED (1996), *The Schools We Need and Why We Don't Have Them*, Anchor Book, Doubleday, New York.

Hirsch, Jr. ED (1997) 'Mathematically Correct'. Speech to the Californian State Board of Education. April 10, 1997.

Hirst, PH, and Peters, RS (1970), *The Logic of Education*, Routledge and Kegan Paul, London.

Hirst, PH (1974), *Knowledge and the Curriculum*, Routledge and Kegan Paul, London.

Hollingsworth, H, Lokan, J & McRae, B (2003), *Teaching Mathematics in Australia: Results from the TIMSS 1999 Video Study, Monograph No 5*, ACER, Camberwell.

House of Commons (2005) *Teaching Children to Read*, Eight Report of Session 2004-05. House of Commons Education and Skills Committee, House of Commons, London.

Jansen, J and Christie, P. Editors (1999), *Studies on Outcomes-based Education in South*

Africa, Kenwyn: Juta and Co, Ltd, South Africa.

Jurgess, H, Schneider, K and Buchel, F (2003), *The Effect of Central Exit Examinations on Student Achievement: Quasi-Experimental Evidence from TIMSS Germany*, CESifo Working Paper No 939, May 2003.

Kerr, D (2000a), 'National Goals', *World-class Curriculum Conference Papers*, pp 8-26, Curriculum Corporation, Melbourne.

Kerr, D (2000b), *Achieving a World Class Curriculum in Australia*, IARTV Seminar Series, August 2000, No 96, IARTV, Melbourne.

Korea Institute of Curriculum and Evaluation (2003), 'A Study for the Improvement of the National Curriculum Revision System', <http://www.kice.re.kr/english/eindex.htm>

Lee, H (2003), 'Outcomes-based Education and the Cult of Educational Efficiency: Using curriculum and assessment reforms to drive educational policy and practice' in *Educational Research and Perspectives* Vol 30, No 2. 2003.

Le Metais, S and Tabberer, R (1997), 'Why Different Countries Do Better: Evidence From Examining Curriculum And Assessment Frameworks in 16 Countries', in the *International Electronic Journal For Leadership in Learning*, Vol 1, Number 3, May 6 1997, <http://www.ucalgary.ca/~iejll/>

Le Metias. J (2002), *New Zealand Stocktake: an international critique*, commissioned by the New Zealand Ministry of Education, Wellington. <http://www.minedu.govt.nz/index.cfm?layout=document&documentid=7258&indexid=1005&indexparentid=1004>

Lokan, J, Ford, P and Greenwood, L (1996), *Maths & Science on the Line*, ACER, Melbourne.

Lokan, J, Ford, P and Greenwood, L (1997), *Maths & Science on the Line*, ACER, Melbourne.

Mann, S (1996), 'An overview of national initiatives: outcomes-based education, including key competencies', a paper delivered at the July, 1996 Curriculum Corporation Conference.

Manno. BV (1994), *Outcomes-based Education: Miracle Cure or Plague?*, Hudson Institute Briefing Paper Number 165 June 1994, USA.

Mathematics Achievement Partnership (2004), *Syllabus K-8 Mathematics*. MAP. US. <http://www.achieve.org/achieve.nsf/MAP?OpenForm>

Marsh. CJ (1994), *Producing a National Curriculum: Plans and Paranoia*, Allen and Unwin, NSW.

Marzano. RJ and Kendall. JS (1997), *The Fall and Rise of Standards-Based Education*. Issues in Brief, National Association of State Boards of Education. USA.

Masters, G (2004), 'Australia's mathematics and science achievement at a standstill', Media Release, Wednesday 15th December, ACER, Melbourne.

Ministry of Education (1994), *English in the New Zealand Curriculum*, Ministry of Education, Wellington,
<http://www.minedu.govt.nz/index.cfm?layout=document&documentid=3550&indexid=1005&indexparentid=1004>

McGaw, Barry. 1994 . 'US/OECD Study on Performance Standards in Education, Quality, Curriculum, Standards, Assessment'. Melbourne. ACER.

McGaw, B (1996), *Their Future: Options for Reform of the Higher School Certificate*, Department of Training and Education Co-ordination, Sydney.

National Centre for Educational Statistics (2000), *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999* <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2001028>

National Foundation for Educational Research. NFER. (2004), *International Review of Curriculum and Assessment Frameworks: Comparative tables and factual summaries*, NFER, London
<http://www.inca.org.uk/comparative.asp>

National Reading Panel (2000), *Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction*.
<http://www.nichd.nih.gov/publications/nrp/smallbook.htm>

National Statistics (2001), 'International Student Assessment: Results for England 2000', Press Release dated 4 December, 2001, National Statistics, London
<http://www.statistics.gov.uk/>

New Zealand Ministry of Education (undated), *Literature Review: the effects of curricula and assessment on pedagogical approaches and on education outcomes*, Ministry of Education, Wellington.

New Zealand Ministry of Education (2002a), *Report on the New Zealand National Curriculum, 2002 – ACER*, Ministry of Education, Wellington.
<http://www.minedu.govt.nz/index.cfm?layout=document&documentid=7473&indexid=1004&indexparentid=1072>

New Zealand Ministry of Education (2002b), *New Zealand Stocktake: an international critique – national foundation for educational research*, Ministry of Education, Wellington.
<http://www.minedu.govt.nz/index.cfm?layout=document&documentid=7258&indexid=1004&indexparentid=1072>

New Zealand Ministry of Education (2002), *English in the New Zealand Curriculum*, on-line version, http://www.tki.org.nz/r/language/curriculum/index_e.php

New Zealand Parliament (2001) *Lets' All Read: Report of the Education and Science Committee on the inquiry into the teaching of reading in New Zealand*, Wellington.

O'Connell, Jack (2005) 'California Accountability System Working: Students making Steady Progress'. <http://www.cde.ca.gov/nr/ne/yr05/yr05rel86.asp>).

O'Donnell, S (2004), *International Review of Curriculum and Assessment Frameworks, Comparative tables and factual summaries – 2004*. Qualifications and Curriculum Authority. <http://www.inca.org.uk/>

OECD (2000), *Education at a Glance: OECD Indicators*, France.

OECD (2001), *Education at a Glance: OECD Indicators*, France.

Qualifications and Curriculum Authority (?), *The National Curriculum English*, <http://www.nc.uk.net/webdav/servlet/XRM?Page/@id=6016>

Raizen, S.A et al (1999), *Facing the Consequences: Using Timss for a Closer Look at U.S. Mathematics and Science Education*, Kluwer Academic Publishers. Boston.

Reid. A (2005), *Rethinking National Curriculum Collaboration: Towards an Australian Curriculum*, DEST, Canberra.

Reynolds. D and Farrell. S (1996), *Worlds Apart? A Review of International Surveys of Educational Achievement Involving England*, OFSTED, London.

Robitaille, D.F et al (1993), *Curriculum Frameworks for Mathematics and Science*, Pacific Educational Press, University of British Columbia, Vancouver.

Robitaille, D.F (1997), *National Contexts for Mathematics and Science Education*, Pacific Educational Press, Vancouver.

Schmidt. W, McKnight. C, Raizen. S (1997), *A Splintered Vision: An Investigation of US Science and Mathematics Education*, <http://ustimss.msu.edu/splintrd.htm>

Shanker, A (1993), *Where We Stand: Outrageous Outcomes*, September 12 1993, American Federation of Teachers. USA

Smithers, A (2004), *England's Education: what can be learned by comparing countries?* The University of Liverpool,

Spady, W (1993), *Outcomes-based Education*, Workshop Report Number 5, ACSA, Canberra

Steiner-Khamsi, G, Silova, I and Johnson, EM (forthcoming), 'Neoliberalism Liberally Applied: Educational Policy Borrowing in Central Asia' in *2006 World Yearbook on Education*, edited by Ozga, J. Seddon, T and Popkewitz, TS.

Stevenson. HW, Lee Shin-Ying, Nerison-Low, R (1999), *Contemporary Research in the United States, Germany, and Japan on Five Education Issues*, US Department of Education, <http://www.ed.gov/pubs/Research5/index.html>

Stigler, JW, Gonzales, P, Kawanaka, T, Knoll, S and Serrano, A (1999), *The TIMSS*

Videotape Classroom Study: methods and findings from an exploratory research project on eight-grade mathematics instruction in Germany, Japan and the United States. NCES 1999-074, Washington DC, NCES.

Stigler, JW and Hiebert, J (1999), *The Teaching Gap*, The Free Press, New York.

Stone, JE (1996), *Developmentalism: An Obscure but Pervasive Restriction on Educational Improvement*, Education Policy Analysis Archives, Vol 4 Number 8, April 21, 1996.
<http://epaa.asu.edu/epaa/v4n8.html>

Sweller, J (2002) 'Why understanding instructional design principles requires an understanding of the evolution of human cognitive architecture.' School of Education. University of NSW. Sydney. j.sweller@unsw.edu.au

Thomson, S and Fleming, N (2004a), *Examining the Evidence: Science achievement in Australian schools in TIMSS 2002*, TIMSS Australia Monograph no 7, ACER, Camberwell, Victoria. http://www.acer.edu.au/research/TIMSS/TIMSS_02_03.htm

Thomson, S and Fleming, N (2004b), *Summing it up: Mathematics achievement in Australian schools in TIMSS 2002*, TIMSS Australia Monograph no 6, ACER, Camberwell, Victoria.
http://www.acer.edu.au/research/TIMSS/TIMSS_02_03.htm

Venter, M. (2000), *Assessing the Assessment of Outcomes Based Education*, Apapdc Conference 2000.
http://www.apapdc.edu.au/archive/ASPA/conference2000/papers/art_3_9.htm

Victorian Curriculum and Assessment Authority (2004), *Curriculum Victoria: Foundations for the Future*, VCAA, Melbourne,

Vinson, T (2002), *Inquiry into the Provision of Public Education in NSW*. Pluto Press Australia, NSW.

Watkins, D and Biggs, J (1996), *The Chinese Learner: Cultural, Psychological and Contextual Influences*, CERC and ACER, Hong Kong.

Watt, Michael (1998), 'National Curriculum Collaboration: The State of Reform in the States and Territories' in *Curriculum Perspectives* Vol 18 No 1 April 1998, pp 21-34, ACSA, Canberra

Watt, Michael (2000), 'The national Education Agenda, 1996-2000: Its Impact on Curriculum Reform in the States and Territories' in *Curriculum Perspectives* Vol 20 No 3 September 2000, pp 37-47, ACSA, Canberra

Williams, D, Ledeman, E, Tancredo, T (1994), *The ABCs of OBE: What's Wrong with Outcomes Based Education*, Independence Institute, Colorado,
<http://www.independenceinstitute.org/article.aspx?ID=631&print=true>

Willis, S and Kissane, B (1997), *Achieving Outcome-Based Education*. ACSA. Canberra.

Wilson, B (1996), *Current Educational Priorities, Future Directions and Initiatives*, IARTV Occasional Paper, IARTV, Melbourne.

Wilson, B (2002), 'Curriculum – is less more? Paper delivered at the Curriculum Corporation Conference 2002, Canberra.

Wisconsin Education Association Council (1995), 'The Debate Over Outcome Based Education', WEAC, <http://www.weac.org/resource/may96/obe.htm>

Woessmann, L (2000), *Schooling Resources, Educational, and Student Performance: the International Evidence*, Kiel Institute of World Economics, <http://ideas.repec.org/p/kiel/kieliw/983.html>

Woessmann, L (2002), *How Central Exams Affect Educational Achievement: International Evidence from TIMSS and TIMSS-Repeat*, a paper presented at Harvard University, June 10-11, 2002, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=387700