Curriculum Mapping Project
Phase 4a
Comparing International Curricula against the Australian Curriculum

Final Report

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Document Tracking

<table>
<thead>
<tr>
<th>Version</th>
<th>Description</th>
<th>Release Date</th>
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<tr>
<td>V1</td>
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<td>13/7/11</td>
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EXECUTIVE SUMMARY

This paper contains the final report on the International Curriculum Mapping Project commissioned by AEEYSOC and set up by ACARA as part of the development of the Australian Curriculum. The project involves an analysis of similarities and differences between the final Australian Curriculum and international curricula in English, Mathematics and Science.

The jurisdictions selected for international comparison were:

- English: Ontario and New Zealand
- Mathematics: Singapore and Finland
- Science: Ontario and Finland.

The criteria on which these selections were made are discussed in the body of the report. The data on the international curricula are drawn from expert mapping conducted on 21 and 22 September 2010. The data on the Australian Curriculum in Mathematics and Science are drawn from expert mapping conducted from 12-21 November 2010. The data on the Australian Curriculum in English are drawn from expert mapping conducted from 7-17 June 2011. The project was designed to provide international benchmarks against which to evaluate the Australian Curriculum. The project reports will also be useful in the further development of the Australian Curriculum.

A separate report compares the final Australian Curriculum with curricula in each state and territory.

The project involved the development of a survey instrument for each learning area based on a consistent language for describing the learning area, including:

- a language for describing the knowledge base; and
- a language for describing the ‘cognitive demand’ of each area, consisting of descriptions of what students can do with particular knowledge.

The survey instrument requires those completing the survey to respond on a matrix to indicate whether a curriculum framework being considered:

- includes a specific topic;
- if so, to what extent; and
- at what level of cognitive demand students are expected to operate in relation to that topic.

International mapping

The conduct of mapping of curricula from other countries had some added complexities. The project consultants were asked by ACARA to develop a paper (see Appendix 1) discussing the potential for mapping of international curricula, and advising on how it might be done. The paper recommended that mapping of English, Mathematics and Science was feasible, but that mapping of History was not realistic because of significant content differences between countries.

The second issue discussed in the paper concerned which international curricula should be mapped for comparison purposes. The paper identified a number of criteria to guide
the selection process. The criteria include Mandatory Criteria, which must have been met for the curriculum to be considered and Desirable Criteria, which would be used to discriminate between curricula that met the Mandatory Criteria. The consultants’ paper proposed that an initial review be conducted of potential comparison curricula and a paper prepared recommending appropriate curricula in priority order. This further paper (see Appendix 2) recommended the following priority order for countries for comparison mapping:

<table>
<thead>
<tr>
<th>English</th>
<th>Mathematics</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. New Zealand</td>
<td>2. Finland</td>
<td>2. Finland</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The findings were accepted by ACARA, and the top two recommended countries in each learning area were included in the mapping process. International curriculum documents for the mapping process were sourced by the project consulting team. These documents are detailed in the body of the report.

The mapping of curricula from the comparison countries occurred in Sydney on 21-22 September, 2010. Curriculum experts from States and Territories and ACARA were brought together to take part in the mapping process. They were provided with a briefing including the background to the project, and a training session in completing the surveys. The project consultants worked with them to respond to questions and provide advice on the completion of the survey. Each rater was asked to map the Australian Curriculum and two international curricula in the same learning area. The same raters were subsequently asked to remap the final Australian Curriculum following changes made to the September version. This further mapping was conducted from 12-21 November, 2010. On this occasion mapping was undertaken online using the site developed by Education Services Australia.

Subsequently, a repeat mapping of the final English curriculum (but not the other subjects) was undertaken. On this occasion a mostly new and enlarged group of raters was brought together in Sydney on 7 June and provided with a training session and the opportunity to work together and moderate their results. Most raters continued the work during the following days, and the final rater data became available on 17 June.

Data arising from these mapping processes were analysed and compared, then compiled into the present report. Appendix 4 outlines the steps involved in this analysis.

The data in the report have some weaknesses. Despite training sessions and consultant availability to the curriculum experts in the completion of the survey, there were inconsistencies in some survey responses. All data for the international report were collected using the online system, which assisted in ensuring data quality, but it is important to remember that the data arise from expert judgment about curriculum and may be subject to errors of rater interpretation.

**Findings**

English showed a very high degree of alignment in content topic coverage between Australia and Ontario. Almost all phases of schooling were aligned at extraordinarily high levels, suggesting that the two curricula are as close as is likely to occur in an international comparison. Cognitive demand was also closely aligned between the two
curricula, although Ontario shows a materially greater representation of ‘Perform procedures/Explain’, and a stronger focus on ‘Generate/Create/Demonstrate’, while Australia had a stronger focus on ‘Memorise/Recall’ and ‘Evaluate’. The data showed a moderate level of alignment in content topic coverage with New Zealand. The variation occurred markedly in three content topic groups that showed consistent and significant differences. In the case of cognitive demand, across the whole curriculum Australia showed a materially greater representation of ‘Evaluate’, while New Zealand was much stronger in ‘Perform Procedures/Explain’. Australia had a greater overall focus on ‘Generate/create...’ and ‘Analyse/Investigate’, while the reverse was true of ‘Memorise’.

In Mathematics, alignment in content topic coverage between the Australian Curriculum and the Singapore and Finland curricula were consistently moderate to high. In the case of Singapore, six phases of schooling showed high alignment, while three showed moderate alignment. In the case of cognitive demand, Singapore shows a materially greater focus across the years of schooling on ‘Solve non-routine problems/make connections’ (most notably in the later primary and early secondary years), while Australia has a materially greater focus on ‘Conjecture/generalise’. While there are some areas of misalignment, overall the results suggest that the two curricula are aligned to a significant degree. The results for Finland showed two phases of schooling with high alignment in content topic coverage and one with moderate alignment. Differences are notably in content topic groups which are represented in both countries, but where the level of emphasis is different. The cognitive demand comparison with Finland is similar to that with Singapore in showing a greater focus in Australia on ‘Conjecture/ generalise’ both overall and at all phases of schooling.

In Science, alignment levels in content topic coverage with Ontario and Finland were mostly moderate, although a significant element in the variation arose from differences in timing rather than differences in curriculum emphasis. Virtually all Ontario phases of schooling were aligned at moderate levels in relation to content topic coverage. In the case of cognitive demand, there were no overall material variations between Australia and Ontario, suggesting a very high level of alignment. All three Finland phases of schooling were aligned in relation to content topic coverage around the boundary between moderate and low alignment. In the case of cognitive demand, Finland showed a materially greater representation of the category ‘Communicate understanding of science concepts’ and a greater focus on ‘Perform procedures/investigate’. Australia showed a greater focus on the higher-order categories of cognitive demand, namely ‘Analyse information and advance scientific argument’ and ‘Apply concepts/make connections’.
Introduction

This paper contains the final report on the International Curriculum Mapping Project set up by ACARA as part of the development of the Australian Curriculum. The project involves an analysis of similarities and differences between the final Australian Curriculum and international curricula in English, Mathematics and Science.

The jurisdictions selected for international comparison are:

English: Ontario and New Zealand
Mathematics: Singapore and Finland
Science: Ontario and Finland.

The criteria on which these selections were made are discussed below. The data on the international curricula are drawn from expert mapping conducted on 21 and 22 September 2010. The data on the Australian Curriculum are drawn from a further mapping process conducted from 12-21 November, 2010 (in Mathematics and Science) and from 7-17 June 2011 (in English). The project is designed to provide international benchmarks against which to evaluate the Australian Curriculum. The project reports will also be useful in the further development of the Australian Curriculum.

This report covers Phases 4 and 4a of the broader Curriculum Mapping Project initiated by ACARA. The first phase of the project involved curriculum experts nominated by each state and territory and ACARA mapping curriculum documents in English, Mathematics, Science and History. Each state or territory document was rated by the experts nominated by that jurisdiction and by those nominated by one other state or territory or ACARA, using the phases of schooling in use for that jurisdiction. Each state or territory provided documents appropriate to the task. The data arising from the expert surveys were then analysed and compiled into an interim report.

In the second phase of the project, each state and territory was invited to nominate teachers to participate in a mapping of the enacted curriculum in that jurisdiction. Six jurisdictions accepted the invitation: ACT, New South Wales, Northern Territory, Queensland, Tasmania and Western Australia. Teachers completed surveys for particular subjects at year levels (rather than phase or stage of schooling). Across Australia, 890 teachers in the six states and territories completed 1196 surveys. Following the completion of the teacher surveys, the results were analysed and combined with the data from the expert surveys to generate a single set of results for each state and territory. For South Australia and Victoria, which did not participate in the teacher mapping, the data in the report were derived from expert mapping only.

The curriculum experts involved in third phase mapping were asked to map three documents each. All participants were asked to map the September version of the Australian Curriculum in one subject. In addition, they mapped two international comparison curricula in the same subject. The jurisdictions selected for international comparison were:

English: Ontario and New Zealand
Mathematics: Singapore and Finland
Science: Ontario and Finland.

The current report is part of Phases 4 and 4a of the project, including two parts:
• This report comparing the final Australian Curriculum with each of the international curricula;
• A report comparing the final Australian Curriculum with curricula in each state and territory, using the same state and territory data as used in the final report on the draft Australian Curriculum. The data drawn from the November 2010 mapping of the Australian Curriculum in Mathematics, Science and History and the June 2011 mapping in English provide the basis for the state and territory comparisons.

The project involved the development of a consistent language for describing each subject addressed in the project, based on a 'uniform language' developed by Porter and colleagues (see Appendix 3 for further information on the source methodology). This includes:

• a language for describing in detail the knowledge base in each of English, science, history and mathematics. This consists of lists of topics arranged in broad content categories in each subject domain. In English, for example, the topic group of ‘Language Study’ includes topics such as ‘spelling’ and ‘effects of race, gender or ethnicity on language and language use’. In Science, ‘ecosystems’ and ‘adaptation and variation’ appear as topics within ‘Ecology’. The lists of topics are intended to be complete and universal, so that they could be used to describe any curriculum in the relevant domain, regardless of year level, context or level of complexity; and

• a language for describing the ‘cognitive demand’ of each area, based on a hierarchy of performance expectations. This consists of descriptions of what students can do with particular knowledge. These descriptions are different for each learning area, though they are based on a similar hierarchy of demands consisting of five levels in categories like the following:
  • memory and recall
  • performing procedures
  • communicating, demonstrating, explaining, creating
  • analysis, argument and investigation
  • evaluation and application in different contexts

A survey instrument was then developed for each subject, based on this ‘uniform language’. The survey instrument was used by expert respondents to describe an official curriculum document, and by teachers to describe their teaching programs. The survey instrument requires those completing the survey to respond on a matrix to indicate whether a curriculum framework or teaching program being considered:

• includes a specific topic;
• if so, to what extent; and
• at what level of cognitive demand students are expected to operate in relation to that topic.

This phase of the project was conducted over an extended period. During the third phase of the overall mapping project, curriculum experts from States and Territories and ACARA were invited to take part in mapping curriculum documents. Those nominated were brought together in Sydney on 21-22 September, 2010. They were provided with a briefing including the background to the project, and a training session in completing the surveys. The project consultants worked with them to respond to questions and provide advice on the completion of the survey. The surveys were
completed using the online system developed on behalf of ACARA by Education Services Australia, in a project managed by the project consultants.

A further mapping of the Australian Curriculum was held in November 2010. This fourth phase involved remapping the Australian Curriculum following revisions undertaken to the September draft. Raters involved in phase 3 were asked to undertake a further mapping of the curriculum as at 12 November, 2010 to ensure that the ratings reflected recent changes to the documents. This mapping process occurred in the period 12-21 November. On this occasion, raters were not brought together, since they had been trained and supported in the phase 3 mapping. Instead, mapping was undertaken online, using the site developed by Education Services Australia.

Phase 4a involved remapping the Australian English curriculum because of concerns about the data set in English following the Phase 4 mapping. The Phase 4 mapping of English resulted in a low number of raters completing the task. This led to the decision to remap English with a larger number of raters, included dedicated primary and secondary school raters. The Phase 4a process began on 7 June 2011 with a training session in Sydney. Raters then undertook the mapping process and were able to moderate their results. Most raters continued the work over subsequent days, completing the work by 17 June 2011 at the latest.

This report compares data arising from the phase 4 and 4a mapping of the final Australian Curriculum with data from phase 3 mapping of curricula from international comparison jurisdictions.

**International mapping**

The conduct of mapping of curricula from other countries had some added complexities. The project consultants were asked by ACARA to develop a paper (see Appendix 1) discussing the potential for mapping of international curricula, and advising on how it might be done. The paper first discussed which subjects were appropriate for international mapping. In summary, the paper recommended that mapping of English, Mathematics and Science was feasible, but that mapping of History was not realistic.

The exclusion of History occurred on the basis that History curricula in different countries strongly reflect local history. Because the mapping methodology requires a rating of specific content as well as cognitive demand, the existence of substantial variations in content makes the methodology inapplicable. The paper also noted that History is less consistently described in curricula in some countries, appearing in different forms (although this issue also applies in Australia, and was not a barrier to completion of the surveys).

The second issue discussed in the paper concerned which international curricula should be mapped for comparison purposes. The paper identified a number of criteria to guide the selection process. The criteria were divided into two categories: Mandatory Criteria, which must be met for the curriculum to be considered; and Desirable Criteria, which would be used to discriminate between the curricula that met the Mandatory Criteria. The criteria are as follows:

**Mandatory criteria**

1. The curricula for comparison must be written in English.
2. Comparison nations must have a relatively well-established system of universal or near-universal primary and secondary education, at least up to the middle years of secondary schooling.
3. The years of schooling must be broadly comparable with those for Australia.
4. The country from which the curriculum for comparison is provided must be willing to assist in the process.

Desirable criteria

5. Partner nations should have variations in starting ages no greater than those existing in Australia.
6. The curricula for comparison should preferably be national curricula.
7. The curricula for mapping should be mainstream curricula designed to cater for a wide range of normal performance.
8. The curricula for comparison should preferably be articulated at year levels (at least in explanatory or support documents) rather than phases or stages of schooling.
9. It would also be desirable for comparisons to be made with nations that have had a degree of success in international assessment programs.
10. Curricula for mapping should be checked for style to ensure comparability.

The consultants’ paper proposed that an initial review be conducted of potential comparison curricula and a paper prepared recommending appropriate curricula in priority order. This further paper was prepared (see Appendix 2). The paper discussed each criterion with the exception of criterion 4, which was set aside in the paper because it requires contact with potential comparison jurisdictions, which was not necessary unless the proposal to subsequently involve personnel from the other jurisdictions in the process were pursued.

The recommended countries for comparison were as follows:

<table>
<thead>
<tr>
<th>English</th>
<th>Mathematics</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. New Zealand</td>
<td>2. Finland</td>
<td>2. Finland</td>
</tr>
<tr>
<td>and Northern Ireland</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The recommendations were accepted by ACARA, and the top two recommended countries in each subject area were included in the mapping process. The latest version of the Australian curriculum was used to form the basis of the comparison. Documents for the mapping process were sourced by the project consulting team. They are outlined in the table below.

<table>
<thead>
<tr>
<th>Country and subject</th>
<th>Documents used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia English,</td>
<td>The subject ‘Organisation’ section, ‘Content statements’,</td>
</tr>
<tr>
<td></td>
<td>Australian Curriculum as at 12 November, 2010.</td>
</tr>
<tr>
<td>Ontario English</td>
<td>The Ontario Curriculum Grades 1-8 Language</td>
</tr>
<tr>
<td></td>
<td>The Ontario Curriculum Grades 9-10 English</td>
</tr>
</tbody>
</table>
The data arising from the expert surveys were then analysed and compiled into this draft report. Appendix 2 outlines the steps involved in this analysis.

The reports

This report summarises the key findings of the project. These can be found at pages 14-21, organized by subject. They include, for each subject, a table showing topic coverage indices for each country for each phase of schooling. The table for each subject is accompanied by a commentary noting the extent of alignment between the Australian Curriculum and curriculum documents in the other two countries, and identifying those areas where the greatest differences are evident.

The detailed data supporting the findings can be found in the attachments to this paper, which are organised by subject. Within each subject, the report analyses data comparing the Australian Curriculum with each comparison country in turn, using the curriculum phases used in each of these countries as the organiser. For each phase for each country, the report includes:

- **Graphs** which represent the outcomes of the mapping processes for the draft Australian Curriculum and the documents mapped for each curriculum phase used in the comparison country. They show the topic and topic group coverage, and the levels of cognitive demand for each of the comparison curriculum phases. The graphs show both the extent of coverage (in simple terms, the area covered by the graph lines) and the extent of emphasis on each topic/topic group and area of cognitive demand (in simple terms, the colour and closeness of the graph lines). The following English graphs show the difference in the spread of the topics covered and the associated extent of emphasis on each topic group and the range of cognitive demands addressed for each topic group.
These sample English graphs indicate that there is significant overlap between the Australian Curriculum and the comparison curriculum at this phase of schooling. The comparison curriculum has a greater focus on ‘Critical reasoning’ but a lesser focus on ‘Language study’. The analysis suggests a high degree of alignment between the two curricula.

It should be noted that the graphs vary in some cases because one curriculum will have a broader coverage (all topic groups) and another will have a narrower coverage (a predominance of a smaller number of topic groups). This will lead to what seems to be greater intensity of coverage for some topic groups for the second curriculum, because the total coverage for each curriculum is 100%. A second reason for variation is the representation of both topic coverage and cognitive demand. If a topic is associated with high ratings for time on topic and substantial levels of cognitive demand, this will produce more apparent intensity in the graph than a case where the topic is associated with low levels of time on topic and cognitive demand.

In the written discussion (see below), there will often be a reference to the level of coverage shown by the graphs, referring, for example, to ‘moderate overlap’ between the comparison country graph and the Australian Curriculum graph. This is an attempt to indicate the extent to which the graphs appear to cover a similar curriculum range. This is not the same as the topic coverage index (see below) which might show a ‘Low’ index despite apparent overlap in the graphs. This is because there will be cases where the different curricula cover the same or similar topic groups, but do so at different levels of intensity, or where each topic group covered is somewhat different in emphasis and the aggregated difference amounts to a significant variation in the topic coverage index.

- **Topic Coverage Indices** for each curriculum phase used in the comparison jurisdiction, represented by a single number less than or equal to 1. The indices provide a measure of the extent to which the comparison curriculum for that
stage of schooling is aligned with the Australian Curriculum. The index has been calculated by comparing the absolute difference in the proportion of the curriculum devoted to each topic by the Australian Curriculum and the comparison curriculum. An index number of 1.00 (or 100%) represents an exact alignment. An index of 0 (or 0%) represents no alignment. These indices are summarised in tabular form at the beginning of each subject report (see 1 above) along with a legend indicating the levels of alignment represented by the different numbers.

- **A table showing the percentage of the curriculum devoted to each topic group** in the Australian Curriculum and the relevant comparison curriculum. The percentage of the curriculum devoted to each topic group is listed for the Australian Curriculum and for each jurisdiction.

The following table relates to the English graphs above:

<table>
<thead>
<tr>
<th>% of Curriculum devoted to Topic Group</th>
<th>Australian Curriculum</th>
<th>Comparison Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonemic Awareness</td>
<td>0.23%</td>
<td>1.54%</td>
</tr>
<tr>
<td>Phonics</td>
<td>0.23%</td>
<td>1.76%</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>4.21%</td>
<td>3.56%</td>
</tr>
<tr>
<td>Text and Print features</td>
<td>3.97%</td>
<td>3.19%</td>
</tr>
<tr>
<td>Language study</td>
<td>10.51%</td>
<td>7.48%</td>
</tr>
<tr>
<td>Critical reasoning</td>
<td>10.28%</td>
<td>12.32%</td>
</tr>
<tr>
<td>Author's craft</td>
<td>9.46%</td>
<td>10.78%</td>
</tr>
<tr>
<td>Writing applications</td>
<td>5.61%</td>
<td>6.82%</td>
</tr>
<tr>
<td>Fluency</td>
<td>1.64%</td>
<td>2.20%</td>
</tr>
<tr>
<td>Comprehending – Reading, Listening and Viewing</td>
<td>17.17%</td>
<td>16.69%</td>
</tr>
<tr>
<td>Writing processes</td>
<td>6.43%</td>
<td>5.57%</td>
</tr>
<tr>
<td>Elements of presentation (multimodal)</td>
<td>7.48%</td>
<td>7.77%</td>
</tr>
<tr>
<td>Listening and viewing</td>
<td>5.96%</td>
<td>5.39%</td>
</tr>
<tr>
<td>Speaking and presenting</td>
<td>11.45%</td>
<td>10.27%</td>
</tr>
<tr>
<td>General capabilities and processes</td>
<td>5.37%</td>
<td>4.66%</td>
</tr>
</tbody>
</table>

The surveys used, showing a full list of topic groups/topics is appended to this report. These tables support a more detailed analysis of differences at the topic group level between the Australian Curriculum and the comparison curriculum. It allows the reader to determine where the important differences lie. In many cases, the extent to which the topic coverage index is below 1 results from the sum of mostly small variations in coverage of the various topic groups. This table is a major component of the brief written analysis (see next point for further discussion, including a set of guidelines for determining the significance of different levels of variation between curricula).

- **A short written discussion** of the key variations between the Australian Curriculum and the comparison curriculum at the level of topic groups. The graphs and this written discussion provide some explanation as to why the topic coverage index is at the level indicated. In the written discussion, the following guidelines have been adopted:

  - a difference of more than 4% between the topic group coverage percentage indicated for the Australian Curriculum and the percentage
indicated for the relevant comparison curriculum (e.g., a difference between 2.1% and 6.4%) is regarded as significant and is referred to in the written commentary;

- a difference of more than 2% but less than 4% is regarded as worth noting but as falling within an acceptable range of variation, and is referred to in the written commentary;

- a case where one framework has a result above 2% and the other has a result of 0% (i.e., the topic is not represented in that framework at that level), is regarded as material and is referred to in the written commentary;

- differences smaller than 2% are regarded as not material, and are not referred to in the written commentary.

- **A discussion of relative cognitive demand** in the subject as represented in the Australian Curriculum and the comparison curriculum. This includes graphic representation of the relative representation of cognitive demand at each phase in the subject and in the subject overall. It also includes a table of percentages of each element of cognitive demand at each phase which are the basis for the graphic representation. In the written discussion, the following guidelines have been adopted:

  - a difference of more than 10% in cognitive demand percentage indicated for the Australian curriculum and the percentage indicated for the relevant comparison curriculum is regarded as significant and referred to in the written commentary
  - a difference of more than 5% but less than 10% is regarded as worth noting but as falling within an acceptable range of variation and is referred to in the written commentary
  - a case where one curriculum has a result above 5% and the other has 0% is regarded as material and referred to in the written commentary
  - differences smaller than 5% are not regarded as material and hence not referred to in the commentary.

The data in the report have some weaknesses. Despite training sessions and consultant availability to the curriculum experts and teachers in the completion of the survey, there were inconsistencies in some survey responses. All data for the international report were collected using the online system, which assisted in ensuring data quality, but it is important to remember that the data arise from expert judgment about curriculum and may be subject to errors of rater interpretation.
This section of the report is based on the expert mapping of the final version of the English curriculum documents for Australia and the two comparison curricula, Ontario and New Zealand. It includes an account of overall results for Australia and the two comparison curricula, and some discussion of any significant differences in coverage.

The table below shows in summary form the topic coverage indices for all phases of the two comparison curricula for English.

<table>
<thead>
<tr>
<th>Year Level</th>
<th>Ontario</th>
<th>New Zealand</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>0.73</td>
<td>0.59</td>
</tr>
<tr>
<td>Yr 1</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>Yr 2</td>
<td></td>
<td>0.65</td>
</tr>
<tr>
<td>Yr 3</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>Yr 4</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td>Yr 5</td>
<td>0.87</td>
<td>0.68</td>
</tr>
<tr>
<td>Yr 6</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>Yr 7</td>
<td>0.87</td>
<td>0.70</td>
</tr>
<tr>
<td>Yr 8</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Yr 9</td>
<td>0.88</td>
<td>0.64</td>
</tr>
<tr>
<td>Yr 10</td>
<td>0.89</td>
<td></td>
</tr>
</tbody>
</table>

It is the view of the consultants that the significance of index levels is as follows (note that the colours used in the legend below are also used to indicate coverage indices in the table above):

<table>
<thead>
<tr>
<th>Index</th>
<th>Level of alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 0.8</td>
<td>Very high</td>
</tr>
<tr>
<td>0.7-0.8</td>
<td>High</td>
</tr>
<tr>
<td>0.6-0.7</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.5-0.6</td>
<td>Low</td>
</tr>
<tr>
<td>Below 0.5</td>
<td>Very low</td>
</tr>
</tbody>
</table>

In English, the alignment level with Ontario was extraordinarily high, especially for an international comparison. Apart from the first phase, all levels were aligned at a very high level, in one case as high as 0.89, which is the highest level achieved throughout the project. The average alignment across all year levels was 0.85. This suggests that the two curricula are exceptionally close in key respects.

The comparison with the New Zealand curriculum shows lower alignment. The average alignment across all levels was 0.65 (moderate alignment), with one phase showing low alignment, three showing moderate alignment and one just into the high range.

This suggests that in English, there is a very high degree of alignment between Australia and Ontario, and moderate alignment with New Zealand.
At a more detailed level, (see Appendix 5) the data show results for topic groups by comparison curriculum and by phase. From this data, the following findings emerge:

1. It was notable that the graphs of the Ontario-Australia comparisons showed very similar patterns. In most cases the high levels of alignment were reflected not only in coverage of topic groups, but also in similar levels of intensity of coverage, and in similar breadth of cognitive demand. This means that the two curricula outline very closely related programs in terms of both curriculum content and cognitive demand.

2. Remarkably, there were only three occasions in the entire Australia-Ontario comparison where a topic group fell outside an acceptable range of difference (ie a difference of more than 4% in the percentage of the curricula devoted to the topic group). All occurred in the early years of schooling and in all three cases the difference concerned a higher representation of ‘Phonics’ in the Australian Curriculum at the first three phases (F-1,2 and 3). Apart from these isolated examples, all topic groups at every level fell within an acceptable range of difference.

3. The analysis of cognitive demand also shows similarities between Australia and Ontario, although there were more areas of material difference. Ontario has a materially greater representation across the curriculum of ‘Perform procedures…’. Australia has a greater focus on ‘Memorise/Recall’ and ‘Evaluate’ overall and at a number of levels, while Ontario has a greater focus on ‘Generate/Create…’ overall and at a number of levels.

4. In summary, this means that the curricula for Ontario and Australia are as close as is likely to occur in an international comparison.

5. In the case of New Zealand, the lower levels of alignment can be tracked in significant part to three topic groups that showed material variations in a consistent direction across a number of year levels. The most striking difference occurred in ‘Comprehending – Reading, Listening and Viewing’ and ‘Elements of presentation (multimodal)’, which were materially stronger in New Zealand at all five phases. ‘Speaking and presenting’ was almost as consistently strong in Australia across all phases. These topic groups appear to show significant and consistent differences in emphasis between the two curricula. ‘Critical reasoning’ was also stronger in New Zealand, though not to the same extent.

6. In the case of cognitive demand, across the whole curriculum Australia showed a materially greater representation of ‘Evaluate’, while New Zealand was much stronger in ‘Perform Procedures/Explain’. Australia had a greater overall focus on ‘Generate/create…’ and ‘Analyse/Investigate’, while the reverse was true of ‘Memorise’.

7. It is important to note that higher or lower levels of alignment are not in themselves measures of quality. They are, to a significant extent, measures of similarity in curriculum coverage and structure. The English data suggest that the Australian curriculum is notably similar to the Ontario curriculum, but has important and identifiable differences from New Zealand.
MATHEMATICS

This section of the report is based on the expert mapping of the final version of the Mathematics curriculum documents for Australia and the two comparison curricula, Singapore and Finland. It includes an account of overall results for Australia and the two comparison curricula, and some discussion of any significant differences in coverage.

The table below shows in summary form the topic coverage indices for all phases of the two comparison curricula for Mathematics.

<table>
<thead>
<tr>
<th>Year Level</th>
<th>Singapore</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yr 1</td>
<td>0.75</td>
<td>0.70</td>
</tr>
<tr>
<td>Yr 2</td>
<td>0.73</td>
<td></td>
</tr>
<tr>
<td>Yr 3</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>Yr 4</td>
<td>0.71</td>
<td>0.72</td>
</tr>
<tr>
<td>Yr 5</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Yr 6</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>Yr 7</td>
<td>0.72</td>
<td>0.63</td>
</tr>
<tr>
<td>Yr 8</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Yr 9</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>Yr 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is the view of the consultants that the significance of index levels is as follows (note that the colours used in the legend below are also used to indicate coverage indices in the table above):

<table>
<thead>
<tr>
<th>Index</th>
<th>Level of alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 0.8</td>
<td>Very high</td>
</tr>
<tr>
<td>0.7-0.8</td>
<td>High</td>
</tr>
<tr>
<td>0.6-0.7</td>
<td>Moderate</td>
</tr>
<tr>
<td>0.5-0.6</td>
<td>Low</td>
</tr>
<tr>
<td>Below 0.5</td>
<td>Very low</td>
</tr>
</tbody>
</table>

In Mathematics, levels of alignment across the two comparison curricula ranged consistently between moderate and high, with a highest alignment index of 0.75 and a lowest index of 0.66. In the case of Singapore, six phases showed high alignment while three showed moderate alignment. The average alignment across the whole curriculum was 0.71. In the case of Finland, two phases showed high alignment and one showed moderate alignment, with an average alignment of 0.68.

This suggests that in Mathematics, alignment between the Australian Curriculum and the Singapore and Finland curricula is consistently moderate to high. The Australian curriculum is broadly consistent with the curricula from the other two countries at the global level.

At a more detailed level, (see Appendix 6) the data show results for topic groups by comparison curriculum and by phase. From this data, the following findings emerge:
1. In the case of Singapore, a number of topic groups showed material variations between the two curricula. The Australian curriculum has a significantly greater representation of 'Number sense...'. At K-1, Year 6 and Year 8 this difference is marked. 'Measurement' is also better represented in Australia, notably at K-1, and Years 4, 5 and 8. 'Instructional technology' appears earlier in the Australian curriculum and is better represented at every year level from Year 2 onwards.

2. Conversely, Singapore has a significantly greater representation of 'Operations' up to Year 5 and on average across the years of schooling. The story is similar with 'Geometric concepts', which constitutes a major focus in Singapore from the beginning of schooling. The group is also present throughout the Australian curriculum at a material level, but at a lower level.

3. Other differences, while less substantial, do reveal some patterns. Australia introduces 'General capabilities and processes' earlier, and has a greater continuing focus, than in Singapore. The same is true of 'Probability', which appears through the Australian curriculum, but only in secondary school in Singapore. 'Basic algebra' is similarly present in both curricula in primary school, but stronger in Singapore in secondary.

4. In about half of the topic groups, the overall difference between the two countries over the years of schooling is negligible. While the topic groups noted above do show patterns of difference, the overall position is that the Australian and Singapore mathematics curricula show acceptable levels of alignment.

5. In the case of Finland, the differences are similar in scale. It is notable that the largest differences occur in those topic groups that have a material representation in both curricula. In most cases, it is not that one country makes a dramatically different set of choices about the focus of mathematics, but that where both countries see a topic group as a priority, one spends somewhat more time on the area.

6. It is worth noting however, that for the three topic groups where Finland shows a materially greater representation than Australia, the direction of difference was the same as in the comparison with Singapore. The greatest variation occurs in 'Geometric concepts'. Here, Finland spends materially more time on the topic group, though it is the third most prevalent topic group in the Australian curriculum. 'Operations' is more evident in the Finnish curriculum, but it is also the fourth most prevalent group in the Australian curriculum. 'Basic algebra' is also stronger in Finland overall, but stronger in Australia in the early years. These three topic groups were also stronger in the Singapore curriculum than in Australia.

7. The Australian curriculum is notably stronger in 'Data displays' throughout schooling, and in 'Probability', especially in the primary years. 'Consumer applications', 'Instructional technology' and 'General capabilities and processes' are also somewhat more evident in Australia, but the differences are less material.

8. Again, as with Singapore, about half of the topic groups show negligible patterns of difference, and alignment across the two curricula is at acceptable levels throughout the years of schooling.

9. In the case of cognitive demand, Singapore shows a materially greater focus across the years of schooling on 'Solve non-routine problems/make connections' (most
notably in the later primary and early secondary years), while Australia has a materially greater focus on ‘Conjecture/generalise’. The comparison with Finland shows a similarly greater focus in Australia on ‘Conjecture/generalise’ both overall and at all phases.
This section of the report is based on the expert mapping of the final version of the Science curriculum documents for Australia and the two comparison curricula, Ontario and Finland. It includes an account of overall results for Australia and the two comparison curricula, and some discussion of any significant differences in coverage.

The table below shows in summary form the topic coverage indices for all phases of the two comparison curricula for Science.

<table>
<thead>
<tr>
<th>Year Level</th>
<th>Ontario</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>Yr 1</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>Yr 2</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>Yr 3</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Yr 4</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Yr 5</td>
<td>0.69</td>
<td>0.60</td>
</tr>
<tr>
<td>Yr 6</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>Yr 7</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>Yr 8</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>Yr 9</td>
<td>0.64</td>
<td>0.63</td>
</tr>
<tr>
<td>Yr 10</td>
<td></td>
<td></td>
</tr>
</tbody>
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It is the view of the consultants that the significance of index levels is as follows (note that the colours used in the legend below are also used to indicate coverage indices in the table above):

<table>
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<tr>
<td>Below 0.5</td>
<td>Very low</td>
</tr>
</tbody>
</table>

In Science, alignment levels with both Finland and Ontario are lower than with comparison curricula in Mathematics. In the case of Ontario, alignment indices are relatively consistent across all year levels, ranging between 0.64 and 0.73. Five levels demonstrate high alignment and five moderate alignment. The alignment with Finland is also clustered, though at somewhat lower levels (0.59-0.66), with two levels showing moderate alignment and one just falling into the low category. Ontario alignment levels are all moderate or high.

This suggests that alignments levels in Science are largely moderate, and somewhat lower than in the other two subjects, taken as a whole.

At a more detailed level, (see Appendix 7) the data show results for topic groups by comparison curriculum and by phase. From this data, the following findings emerge:
1. The alignment of the Australian Science curriculum with that of Ontario is generally at acceptable levels, almost completely in the ‘Moderate’ range. A notable cause of this concerns the sequencing of elements of the science curriculum. This is particularly evident in the number of topic groups that appear at a material level in one curriculum at a level, but not in the other.

2. There are two broad possible explanations for this phenomenon. The first is that the two curricula simply focus on different aspects of science. The second is that while they focus on similar aspects of science, they time and sequence them differently. The data support the second explanation. An examination of the prevalence of different topic groups across all the years of schooling reveals that there are no topic groups showing a material difference in overall coverage. The topic group with the greatest variation is ‘Nature of science’ where Australia has a greater focus across the curriculum than Ontario but the difference is not material. All topic groups show a relatively consistent overall coverage across the two curricula.

3. This makes clear that the material difference between Ontario and Australia in Science is sequencing. Some examples illustrate the point. ‘Evolution’ receives its greatest focus in Australia at Years 7 and 10. In Ontario it is virtually absent from 7-10, but represented in the primary years, especially Grade 6. ‘Animal biology’ is much better represented in Ontario at Grades 1, 2 and 10, but the reverse is true at most other years of schooling. ‘Human biology’ receives a major focus on Ontario at Grade 5 (where is almost unmentioned in the Australian curriculum) and Grade 10, but is a focus in Australia at Years 8 and 9. ‘Ecology’ is a major focus in Ontario at Grades 4 and 7 but in Australia at Years 6 and 8.

4. The differences between the two curricula are virtually all to do with the timing and sequencing of topics, and hardly at all to do with significantly different overall emphases. There are, however, two topic groups which show relatively consistent differences. ‘Nature of science’ shows a somewhat greater representation of the topic group in Australia at every year level, the difference being especially marked at Years 5 and 6. This suggests a real difference in approach between the two countries, and a more explicit focus in this country on ideas about the practice of science. While the difference is less dramatic, ‘Measurement and calculation in science’ is also better represented in Australia at all levels except Years 8 and 9.

5. There are, therefore, some topic groups where there does appear to be a variation in the value attributed to them by the two countries. In general, however, Australia and Ontario have made closely related decisions about what students should learn, but somewhat different decisions about when they should learn each topic group. This suggests that taking the curriculum as a whole, the levels of agreement between Ontario and Australia about the Science curriculum are very high.

6. In the case of Finland, alignment levels are somewhat lower, but this difference is not strongly evident at the topic group level, partly because there are more groups and so fewer cases where a small number of groups dominate the coverage. The greatest variation occurs in the case of ‘Earth systems’ and ‘Ecology’ which are substantially better represented in the Australian curriculum at all levels. Finland shows somewhat stronger representation of ‘Science, health and environment’, ‘Human biology’, ‘Energy’, ‘Chemical reactions and formulas’ and ‘General capabilities and processes’ at all levels of schooling.
7. There are also isolated cases where there are significant differences in sequencing, but not in overall emphasis. ‘Components of living systems’ for example, is stronger in Finland in the early years, but this is reversed from Year 5 onwards. ‘Astronomy/space’ is stronger in the early and later years in Australia, but the reverse is true in the middle years. These differences appear to be variations in timing rather than emphasis.

8. Despite the somewhat lower levels of overall alignment, it is notable that 15 of the 29 topic groups show negligible levels of variation between Australia and Finland across the years of schooling. While the indices show moderate levels of alignment between the Finnish and Australian science curricula, it seems that the material variation is largely confined to a small number of topic groups.

9. In the case of cognitive demand, it is notable that there are no overall material variations between Australia and Ontario in science. Even at specific years levels, there are very few examples of material variation. This suggests a very high degree of alignment in cognitive demand. The position with Finland is, however, different. Finland has a materially greater representation of ‘Communicate understanding of science concepts’ and a greater focus on ‘Perform procedures/investigate’. Australia has a greater focus on both ‘Analyse information and advance scientific argument’ and ‘Apply concepts/make connections’.
APPENDIX 1: INTERNATIONAL MAPPING PROPOSAL

Introduction
The draft Australian curricula for English, mathematics, science and history, K-10, have been mapped to both the curriculum documentation in each of the states and territories and to what a significant sample of teachers around Australia actually teach. ACARA now seeks a proposal for the conduct of a mapping process to compare the Australian Curriculum with international peers. It is anticipated that the process would be conducted using the final released version of the curriculum. This proposal concerns the four subjects developed as part of Stage 1.

Issues to resolve
There are two issues to consider prior to the development of a detailed proposal. The first concerns which subjects would be able to be mapped internationally. The second concerns the identification of appropriate international peers.

Which subjects?
Of the four subjects developed to date, it is likely that mathematics would be most amenable to international comparison. This reflects the fact that mathematics is subject to considerable international commonality and is not unduly affected by cultural matters. The review of the Porter survey instrument for mathematics led to relatively limited changes to suit Australian curriculum although it was clear that the Australian reviewers (nominated by ACARA) felt that the changes were worth making. It is likely that the instrument would be useable internationally, but this would need to be resolved with potential international partners if they were to be involved in the mapping process.

Science is also likely to be generally comparable internationally, although there are some variations in subject arrangements that could make the comparison more difficult in some jurisdictions. In Hong Kong, for example, primary school science is incorporated in General Studies, which also includes Social Studies and Health Education. In Singapore, science is not taught until Year 3. These variations would make the form of international mapping in science more problematic, but ways could be found to accommodate them.

English should also be manageable for international mapping, though it may be somewhat more difficult than mathematics. English teaching is somewhat more culturally specific than mathematics, in that the theoretical framework of English teaching is somewhat culturally specific, and it is possible that some approaches and references might be unfamiliar to some international curriculum raters. The Australian survey, for example, includes elements to do with Viewing (eg ‘screen conventions’ under Text and print features) which were not part of the US survey and which may not be familiar to raters in other countries. The Australian version also includes more material related to a view of English as culturally located, such as ‘Use of language to generate different responses’ and ‘Relationship of form and structure of language use to cultural context’ (both under Language study) which may not be as familiar to international raters. These differences are, however, relatively minor and could be accommodated by noting them for international raters.

A further issue potentially affecting English concerns some of the likely peer nations. Singapore and Hong Kong, for example, have student cohorts for whom English is not always their first language, and it is possible that their curriculum documents in English are affected by the need to deal with multiple official languages. This could make mapping a less useful exercise. On the other hand, these are two of our natural regional peers, and would provide valuable comparisons.
In the case of history, the survey instrument was almost completely rewritten for Australian use. It was clear that the Porter survey would not be suitable to mapping history in this country because of the volume of Australia-specific material contained in the draft curriculum document. This issue will recur in any international mapping process, and is likely to make any international history mapping impossible except by using a generic survey stripped of content identifiers. This is not likely to be a useful approach. This difficulty is exacerbated by the limited extent to which history is identified as a separate subject in some primary school curricula. In Singapore it is part of Social Studies in the primary years. In Hong Kong it is part of General Studies in primary schools.

On the basis of this analysis, it is proposed that international mapping of English, mathematics and science would be feasible, but that history is not feasible.

**Which international peers?**
The second issue requiring resolution concerns which countries would provide appropriate and feasible comparison curriculum documents. The discussion below is intended to provide a basis for the establishment of a short list of criteria, some of which should be mandatory and some of which constitute preferences. These criteria should guide the choice of international mapping partners.

**Mandatory criteria**

1. The curricula for comparison must be **written in English**. It is not realistic to compare curricula across linguistic boundaries. Apart from those cases where the curriculum is written in a language other than English, there are cases where English is not the medium of instruction in schools (eg Hong Kong), or where English is the medium of instruction but most students have a different mother tongue (eg Singapore). It will be important to determine the extent to which variations of this kind would affect the validity of the comparison.

2. Comparison nations must have a relatively **well-established system of universal or near-universal primary and secondary education**, at least up to the middle years of secondary schooling. In India, for example, fewer than 40% of adolescents attend secondary school, half of India’s students leave school by 14 and half of 10-year-old children cannot read at a basic level. These circumstances mean that a curriculum mapping comparison would be less meaningful and would carry little weight with users of the data.

3. The **years of schooling must be broadly comparable** with those for Australia. It is worth noting that PISA, for example, avoids this problem by sampling students by age rather than by year of schooling. Table 1 below illustrates some of the variations in equivalent year levels up to Australia’s Year 10 between some natural comparison systems. It illustrates some practical difficulties in the development of international comparisons, although it also demonstrates that the difficulties largely occur in the first year or two of schooling. On the basis of the data below, it is proposed that each of these curricula would be suitable for mapping because the differences are relatively minor.
Australia | England and Wales | USA | Hong Kong
---|---|---|---
K | Reception | Kindergarten | Kindergarten
Year 1 | Year 2 | Grade 1 | Primary 1
Year 2 | Year 3 | Grade 2 | Primary 2
Year 3 | Year 4 | Grade 3 | Primary 4
Year 4 | Year 5 | Grade 4 | Primary 5
Year 5 | Year 6 | Grade 5 | Primary 6
Year 6 | Year 7 | Grade 6 | Form 1
Year 7 | Year 8 | Grade 7 | Form 2
Year 8 | Year 9 | Grade 8 | Form 3
Year 9 | Year 10 | Grade 9 | Form 4
Year 10 | Year 11 | Grade 10 | Form 5

Table 1: Comparative Years of Schooling

4. **The country** from which the curriculum for comparison is provided **must be willing to assist in the process.** The evidence from the state and territory expert mapping process is that even individuals with strong curriculum backgrounds and experience in subject areas find it difficult and time-consuming to understand the conceptual framework and style of specification in an unfamiliar curriculum. The expert mapping would have been significantly more difficult if it were not for the participation of experts from each of the jurisdictions in the process, assisting those unfamiliar with their curriculum documents. Even the determination of which document(s) to use was problematic. In Australia, curriculum documents have relatively similar provenance and many share common approaches (e.g., phase or stage specification and an outcomes basis). In cases where such difficulties are exacerbated by different national traditions and assumptions, the problems would be magnified, and the participation of personnel from the comparison states would be essential.

**Desirable criteria**

5. An issue related to the year level structure (see 3 above) concerns school starting ages, which is also an issue in Australia. While this issue does not directly affect comparisons of curricula, it might indirectly affect what is included in curricula, especially during the early years. Children start school at four in Ireland, but at five in England, Scotland, and Wales (although in England and Wales, many children start at four). In the Netherlands, schooling is compulsory from the age of five, but many children start before this. In New Zealand, Denmark, France, and Germany, schooling starts at six. In Norway, children must start school in the year they turn seven, while schooling starts at seven in Sweden and Finland. In the United States, as in Australia, starting age is determined by each state or territory, and they differ substantially, although thirty-eight states now have cut-off dates requiring children entering kindergarten to be five years old before October 16 in the year before they enter school. On this basis, it is proposed that **partner nations should have variations in starting ages no greater than those existing in Australia.**

6. The curricula for comparison should preferably be **national curricula.** While it would be possible, for example, to select one or more of the state curricula in the United States or the provincial curricula in Canada, this would probably not have the status of
comparisons involving national curricula, and could provide additional barriers to comparison (e.g., local specificity). These curricula are, however, easily available for mapping and would have considerable structural and other similarities to Australian curricula, making the process more manageable. It should be noted that the involvement of American states in the process could raise an issue about the adaptation of the Porter methodology and survey instruments, since some would have participated in mapping using the original methodology and surveys. It could also, however, be valuable because of the potential availability of trained raters (and possibly of existing data for a large proportion of the survey items).

7. A further complication concerns the extent to which countries have differentiated curricula, especially in the secondary school. In Singapore, the results of the Primary School Leaving Examination determine which of four secondary education tracks students enter. Each track has its own curriculum structure. This makes the identification of the appropriate curriculum for mapping more difficult. It is proposed that curricula for mapping should be mainstream curricula designed to cater for a wide range of normal performance.

8. The curricula for comparison should preferably be articulated at year levels (at least in explanatory or support documents) rather than phases or stages of schooling. In the Australian mapping, the comparison of the year level basis of the Australian Curriculum with phase- or stage-based state and territory curricula was managed through the use of an algorithm to enable the comparison. While this approach works, it adds an additional layer of complexity in the process. International comparisons will already involve additional degrees of difficulty and complexity, and it would be best to avoid unnecessary additional complications.

9. It would also be desirable for comparisons to be made with nations that have had a degree of success in international assessment programs. There is little point in a comparison with a nation that has been identified as performing poorly by comparison with Australia, in part because the comparison will carry less weight with users.

10. There may also be an issue in some cases about the style in which the curriculum is written, and its accessibility to international raters. This is a marginal issue, but it is proposed that curricula for mapping should be checked for style to ensure comparability. This extract from the Scottish Curriculum for Excellence document for Literacy and English at the second curriculum level (covering learning up to the end of Primary year 7) illustrates a style issue which may affect the mapping process:

As I listen or watch, I can identify and discuss the purpose, main ideas and supporting detail contained within the text, and use this information for different purposes.

As the set of issues identified above makes clear, the identification of partner nations with which to compare curricula is complex. There are almost no curricula that satisfy all of the criteria and preferences above. Singapore comes close. Its curriculum is written in English (as well as Chinese), it has broadly similar arrangements for schooling, children start school at 6-7 but have two years of Kindergarten before, it has a national curriculum, it does well in international comparisons, has a well-established universal education system and its curriculum is written in a familiar style. Its curriculum is not, however, clearly aligned with year levels, and it has differentiated curricula for different tracks.

It is proposed that a review be undertaken to determine which curricula have the highest degree of alignment with the criteria and preferences outlined above, that a selection of these
be made and that selected countries be approached to determine their interest in taking part in international mapping.

The extent to which, and the means by which, resulting data would be published or otherwise disseminated might affect the participation of other nations. It is likely that participating nations would want the capacity to check the data before finalisation, and to exercise a degree of control over the public use of data arising from the mapping of their curricula.

**Process for mapping**

In principle, it would be possible to adopt a range of different options for the conduct of the mapping process. These could include:

- A model based directly on the Australian expert mapping process, with international systems taking the place of states and territories. This is the preferred model discussed in more detail below.

- A model involving each participating system mapping its own curriculum in situ, along with one other curriculum, and submitting completed surveys. This would require a training session in each participating country and assistance with survey completion. It would be more difficult for participating experts to complete surveys of curricula with which they were not familiar because of the absence of expert advice from those familiar with the curriculum being mapped. This model is easier and less expensive to set up but is likely to produce less reliable data.

- A model involving completion of all surveys by Australian experts from states and territories (and ACARA if desired), followed by some checking process involving experts from the participating systems. This approach would be the easiest and cheapest to implement, and could probably draw on at least some experts already familiar with the methodology, providing them with a valuable professional development experience. The lack of involvement in the survey process of experts from the participating jurisdictions would, however, substantially weaken the process. It is difficult to see why other systems would agree to a process of this kind, since it puts responsibility for mapping their curricula (and using the results) in other hands.

Variations could be developed around each of these models. On balance, however, based on the integrity of the process, the first model is recommended. The conduct of international mapping should be based as far as possible on the existing Australian methodology, and must use the Australian surveys so the data is directly comparable. The process should include the following elements:

- Involvement of personnel from each of the participating systems in the mapping process. This is designed to ensure that the curricula to be mapped are well understood and that personnel who are familiar with each document are available to assist other raters in making judgments. In the Australian mapping process, it was clear that some raters found it difficult to grasp the conceptual organisation of curricula from other jurisdictions and that this affected their capacity to make reliable judgments. This difficulty may be greater with international raters and curricula.

- Face-to-face training to ensure that all raters understand the methodology. In the Australian experience, even with face-to-face training some raters found it difficult to understand and apply the methodology.

- Allocation of raters to their own and one other curriculum to ensure that each curriculum is rated by experts who are familiar with it, and by experts who are independent.

- Engagement of raters for at least three full days to allow them to become familiar with the methodology and to practice the rating process prior to completion of a survey. In the Australian case, although most raters were involved for at least two full days, some took
a considerable time to master the methodology and some found it impossible to complete two full surveys in the time available. Following the training and survey completion session, it was difficult to persuade raters to complete and submit unfinished surveys.

- Use of the online survey process to simplify and systematize the process.

The consultants who took responsibility for the Australian mapping, or by others nominated by ACARA could manage such a process.

In addition, it will be necessary to develop a means for involving participating countries. This process should involve the preparation of a statement about how countries were selected for invitation to participate, a detailed summary of the process to be involved, the expectations of participants and the rules governing the publication and use of the resulting data.

**Recommendations**

11. That if ACARA decides to proceed with an international mapping process, the procedure for the Australian expert mapping process be adopted.

12. That the international mapping process focus on English, mathematics and science at Years K-10.

13. That a review be undertaken to determine which international curricula have the highest degree of alignment with the criteria and preferences outlined above, that a selection of these be made and that selected countries be approached to determine their interest in taking part in international mapping.

14. That a protocol be prepared for participating jurisdictions outlining:
   - how countries were selected for invitation to participate;
   - the process to be involved including required elements;
   - expectations of participants; and
   - rules governing how data from the survey would be quality assured and how control of publication, dissemination and use would be managed.
APPENDIX 2: INTERNATIONAL MAPPING REPORT

Introduction
ACARA has decided to map the final version of the Australian Curriculum in English, Science and Mathematics against selected international curricula to provide benchmarks for the new curriculum. It was resolved not to map History because of substantial content differences between countries. This paper provides advice on which international curricula are most appropriate to the task.

Criteria
The consultants prepared a paper at the request of ACARA setting out, inter alia, criteria for the selection of international comparison curricula and arguments for the adoption of these criteria. The criteria were divided into two categories: Mandatory Criteria, which must be met for the curriculum to be considered; and Desirable Criteria, which would be used to discriminate between the curricula that met the Mandatory Criteria. The criteria are as follows:

Mandatory criteria

11. The curricula for comparison must be written in English.

12. Comparison nations must have a relatively well-established system of universal or near-universal primary and secondary education, at least up to the middle years of secondary schooling.

13. The years of schooling must be broadly comparable with those for Australia.

14. The country from which the curriculum for comparison is provided must be willing to assist in the process.

Note that criterion 4 has been ignored in this paper, because it requires contact with potential comparison jurisdictions, which is not necessary until a later stage of the process.

Desirable criteria

15. Partner nations should have variations in starting ages no greater than those existing in Australia.

16. The curricula for comparison should preferably be national curricula.

17. The curricula for mapping should be mainstream curricula designed to cater for a wide range of normal performance.

18. The curricula for comparison should preferably be articulated at year levels (at least in explanatory or support documents) rather than phases or stages of schooling.

19. It would also be desirable for comparisons to be made with nations that have had a degree of success in international assessment programs.

20. Curricula for mapping should be checked for style to ensure comparability.

The consultants’ paper proposed that an initial review be conducted of potential comparison curricula and a paper prepared recommending appropriate curricula in priority order. This paper is intended to satisfy that recommendation.
The original paper noted that there appeared to be no curricula that satisfied all of the criteria.

**Criterion 1: The curricula for comparison must be written in English.**

The first criterion, that the curriculum be written in English, if strictly applied, would rule out most of the potential comparison curricula. Other than Australia, of the countries which performed best in Programme for International Student Assessment (PISA) Science, Reading and Mathematics in 2006 (scoring at or higher than the OECD average in all subjects) for example, only five candidates have curricula written in English: Canada, New Zealand, Hong Kong, the United Kingdom and Ireland. Note that curriculum in the United Kingdom consists of the Scottish Curriculum and the National Curriculum for England, Wales and Northern Ireland.

Apart from these candidate countries, Singapore, which also has a curriculum written in English (as well as Chinese), did not participate in PISA 2006 but has performed well in other test years. The United States has curricula written in English (but has no national curriculum and has not generally performed well in PISA).

Some countries which do not have curricula written in English have translations into English. Finland, which has been the most consistent high performer in PISA, is one example. The Finnish translated curriculum is of good quality, so has been included in the next stage of the analysis because of the extremely high international reputation of Finnish education.

The eight curricula selected for further analysis are:

Canada  
New Zealand  
Hong Kong  
England, Wales and Northern Ireland  
Scotland  
Singapore  
Finland  
United States

**Criterion 2: Comparison nations must have a relatively well-established system of universal or near-universal primary and secondary education**

All eight of the potential comparison curricula come from countries with effectively universal education systems.
Criterion 3: The years of schooling must be broadly comparable with those for Australia.

<table>
<thead>
<tr>
<th>Country</th>
<th>Canada</th>
<th>New Zealand</th>
<th>Hong Kong</th>
<th>England, Wales</th>
<th>Scotland</th>
<th>United States</th>
<th>Singapore</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>K#</td>
<td>Year 0*</td>
<td>Primary 1</td>
<td>R</td>
<td>Primary 1</td>
<td>K</td>
<td>K1</td>
<td>Pre-school+</td>
</tr>
<tr>
<td>Year 1</td>
<td>Grade 1</td>
<td>Year 2</td>
<td>Primary 2</td>
<td>Year 2</td>
<td>Primary 2</td>
<td>Grade 1</td>
<td>Primary 1</td>
<td></td>
</tr>
<tr>
<td>Year 2</td>
<td>Grade 2</td>
<td>Year 3</td>
<td>Primary 3</td>
<td>Year 3</td>
<td>Primary 3</td>
<td>Grade 2</td>
<td>Primary 2</td>
<td>Year 1</td>
</tr>
<tr>
<td>Year 3</td>
<td>Grade 3</td>
<td>Year 4</td>
<td>Primary 4</td>
<td>Year 4</td>
<td>Primary 4</td>
<td>Grade 3</td>
<td>Primary 3</td>
<td>Year 2</td>
</tr>
<tr>
<td>Year 4</td>
<td>Grade 4</td>
<td>Year 5</td>
<td>Primary 5</td>
<td>Year 5</td>
<td>Primary 5</td>
<td>Grade 4</td>
<td>Primary 4</td>
<td>Year 3</td>
</tr>
<tr>
<td>Year 5</td>
<td>Grade 5</td>
<td>Year 6</td>
<td>Primary 6</td>
<td>Year 6</td>
<td>Primary 6</td>
<td>Grade 5</td>
<td>Primary 5</td>
<td>Year 4</td>
</tr>
<tr>
<td>Year 6</td>
<td>Grade 6</td>
<td>Year 7</td>
<td>Form 1</td>
<td>Year 7</td>
<td>Primary 7</td>
<td>Grade 6</td>
<td>Primary 6</td>
<td>Year 5</td>
</tr>
<tr>
<td>Year 7</td>
<td>Grade 7</td>
<td>Year 8</td>
<td>Form 2</td>
<td>Year 8</td>
<td>S1</td>
<td>Grade 7</td>
<td>Year 1</td>
<td>Year 6</td>
</tr>
<tr>
<td>Year 8</td>
<td>Grade 8</td>
<td>Year 9</td>
<td>Form 3</td>
<td>Year 9</td>
<td>S2</td>
<td>Grade 8</td>
<td>Year 2</td>
<td>Year 7</td>
</tr>
<tr>
<td>Year 9</td>
<td>Grade 9</td>
<td>Year 10</td>
<td>Form 4</td>
<td>Year 10</td>
<td>S3</td>
<td>Grade 9</td>
<td>Year 3</td>
<td>Year 8</td>
</tr>
<tr>
<td>Year 10</td>
<td>Grade 10</td>
<td>Year 11</td>
<td>Form 5</td>
<td>Year 11</td>
<td>S4</td>
<td>Grade 10</td>
<td>Year 4</td>
<td>Year 9</td>
</tr>
</tbody>
</table>

Table 1: Comparative Years of Schooling

* Often not a separate year, but integrated into Year 1
# Ontario Kindergarten, for example, is not full time or compulsory, and is offered for four and five year old children
+ Finland has only nine years of schooling up to the equivalent of Year 10 in Australia, children usually starting school at seven

The key issues for effective comparisons arising from this set of data are:

1. Finland has only nine years of schooling and children usually start school at seven. This means that comparisons with the Australian Curriculum for the early years are problematic. While Year 10 in Australia is equivalent to Year 9 in Finland, the same is not true of the first year or two of schooling. Despite this, the comparability of most years of schooling means that the mapping process is feasible.

2. The ‘K’ year in Australia will align only imperfectly with equivalent points in schooling in some countries, but from Year 1 onwards the alignment is probably sufficiently close to use for comparison purposes. In Singapore, for example, K1 and K2 are the second and third years of a non-compulsory kindergarten program provided by the private sector. Schooling proper begins with Year 1. New Zealand has a Year 0, essentially to manage the differentiated entry points of children with different birth dates, but this should not affect the comparison. The ‘R’ year in England is part of the Foundation Stage of the curriculum, but is delivered in school.

3. In both Canada and the United States, arrangements vary between provinces or states. The comparison project will, in any case, have to select provincial or state curricula, since there are no national curricula. In the case of Canada (see below) Ontario has been selected. Ontario has a relatively new one full day of kindergarten, but this is not compulsory or universal. In other respects, Ontario matches the Australian structure.

Criterion 4: The country from which the curriculum for comparison is provided must be willing to assist in the process.
This criterion is not in use at this stage of the analysis (see above)

**Criterion 5: Partner nations should have variations in starting ages no greater than those existing in Australia.**

<table>
<thead>
<tr>
<th>Country</th>
<th>Starting Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>K: 5 or 6</td>
</tr>
<tr>
<td>Canada</td>
<td>Year 1: 6 or 7</td>
</tr>
<tr>
<td>New Zealand</td>
<td>5</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Primary 1: usually 5</td>
</tr>
<tr>
<td>England, Wales</td>
<td>Year 1: usually 5</td>
</tr>
<tr>
<td>Scotland</td>
<td>4½ to 5½</td>
</tr>
<tr>
<td>Singapore</td>
<td>Primary 1: usually 7</td>
</tr>
<tr>
<td>United States</td>
<td>K: usually 5 or 6</td>
</tr>
<tr>
<td>Finland</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 2: Comparative Starting Ages

It is assumed that in Australia, children mostly start school at five or sometimes six. There are material differences in starting ages between Australia and some of the countries under consideration. In most cases, the differences fall within the tolerance accepted in the mapping of curriculum from the Australian States and Territories, but there are exceptions.

Children in Finland usually start school at seven, and occasionally at six. This means that children starting school in Finland are in some cases more than two years older than children in some Australian schools. It was noted above that comparisons between Finland and Australia in the early years may be problematic.

Children in Singapore usually start Primary 1 at seven, or sometimes six. Although there are three pre-school years prior to Primary 1, these are not compulsory. Primary 1 is probably broadly comparable with Australia’s Year 1.

The other countries fall within the tolerances accepted in the Australian mapping process.

**Criterion 6: The curricula for comparison should preferably be national curricula.**

Of the eight countries under consideration, all have national curricula (or its equivalent) except Canada and the United States. The curriculum in Hong Kong is regarded as a national curriculum, despite Hong Kong’s political status. In the case of Canada, it would be possible to use the Ontario curriculum as a comparison, because of the high regard in which the Ontario system is held internationally, and the generally strong performance of Canada (and Ontario) in international comparisons. In the case of the United States, the absence of a national curriculum and the country’s weaker performance in international comparisons suggests that it would be undesirable to select a state curriculum for comparison purposes. On this basis, the United States is eliminated from the evaluation.
Criterion 7: The curricula for mapping should be mainstream curricula designed to cater for a wide range of normal performance.

Most systems under consideration have a common mainstream curriculum.

Singapore conducts a Primary School Leaving Examination at the end of Primary 6, and on the basis of results in this assessment students are placed in different secondary education streams. While Mathematics in primary is common, there are different Mathematics curricula for the different streams in secondary. In the Normal (Technical) and Normal (Academic) streams, Science is not compulsory, but is available as an elective. Science is common in primary school, but syllabuses seem to reflect the different streams in secondary school.

The other countries involved have an essentially mainstream curriculum structure, despite opportunities in some systems (eg Hong Kong) for subject and course choices in the middle of secondary school.

Criterion 8: The curricula for comparison should preferably be articulated at year levels (at least in explanatory or support documents) rather than phases or stages of schooling

The value of a curriculum written in year levels is that it enables an easy comparison with Australia. Curricula written in phases or stages can be compared relatively easily if the phases are directly linked to year levels. Where loosely-coupled phases are provided, the phases need to be formally linked to specific year levels to enable the mapping report to be written.

Only Ontario’s curriculum is fully articulated at year levels. Hong Kong’s curriculum is laid out in Key Stages, but units are allocated to year levels, so it is easily comparable with Australia.

Singapore curriculum varies in its structure. Mathematics is set out in year levels. Science is presented in multi-year blocks (eg Primary 3-6).

In England, Wales and Northern Ireland, curriculum is articulated in key stages comprising specified years of schooling. In the case of Finland, the curriculum is set out in three phases up to the end of Year 9 (equivalent to Year 10 in Australia). In Scotland, the curriculum is set out in five levels that are only loosely linked with year levels. New Zealand’s standards are set out over eight levels, of which about six are related to Years K-10, though the alignment is loose.

Criterion 9: It would also be desirable for comparisons to be made with nations that have had a degree of success in international assessment programs.

All curricula selected for evaluation come from countries that have performed well in international assessment programs such as PISA, Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS). All seven remaining curricula satisfy this criterion. Finland was the best performing country in PISA 2006 Mathematics, Reading and Science and has an exceptionally strong international reputation.
Of the other countries under consideration, Hong Kong, Canada and New Zealand had the best results in each of Reading, Mathematics and Science. In each case, the United Kingdom was at or above the OECD average. Singapore did not participate in PISA in 2006.

TIMSS results in 2007 showed Hong Kong and Singapore were the best performing countries, Singapore having been the best performer in 1995 and 2003.

Hong Kong and Singapore did best in PIRLS in 2006 along with Ontario. England performed better than Scotland and New Zealand, though all were above the PIRLS average.

**Criterion 10: Curricula for mapping should be checked for style to ensure comparability.**

Curricula from most of the countries/regions included for evaluation follow a style that is sufficiently consistent with the writing of the Australian Curriculum to enable effective comparison. This is particularly the case for Ontario, Singapore and Finland and the new curriculum in New Zealand.

The Scottish curriculum adopts a different style of writing:

> To help me develop an informed view, I am learning to recognise the difference between fact and opinion

While this is distinctive, it may be amenable to comparison, though the style would probably make the comparison task somewhat more difficult.

**Other Issues**

A further set of issues concerns the way in which specific subjects are articulated in the curriculum or offered in schools.

Hong Kong does not offer Science as a standard subject in primary schools, although it is taught in some schools. Science in the primary school curriculum is incorporated as part of a General Studies course. Finland divides Science into a number of parts: Environmental and Natural Sciences (or studies), appearing at Years 1-4; Biology and Geography appearing as a single subject at Years 5-6; Biology at Years 7-9; Physics and Chemistry at Year 5-6; and Physics and Chemistry separately at Years 7-9. This is complex, but does offer a rich set of data for comparison. Singapore does not include Science in its curriculum statement until Primary 3.

The position of English in Finland, Hong Kong and Singapore means that it would probably be inappropriate to use curricula in these countries as comparison documents with Australia. In Hong Kong, only a handful of schools can maintain English as the medium of instruction, so that English is very widely a second language in schools. In Singapore, although education is largely conducted in English, it is a second language for a proportion of students. In Finland, English is almost universally a second language.

In addition, there are political and educational judgments to make about those countries that would most generally be viewed as appropriate benchmarks for Australia. It is probably the case, for example, that in the general community economically successful countries will be seen as better benchmarks, while in the educational community countries which do better in international assessments may be seen as more appropriate.
DISCUSSION AND RECOMMENDATIONS

The data assembled in this paper are summarized in the table below. Where a curriculum satisfies the criteria, a ‘Yes’ appears. Where no comment appears, the curriculum does not satisfy the criteria. In cases where the judgment is difficult to resolve, a question mark appears.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Canada: Ontario</th>
<th>New Zealand</th>
<th>Hong Kong</th>
<th>England, Wales and Northern Ireland</th>
<th>Scotland</th>
<th>Singapore</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written in English</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>?</td>
</tr>
<tr>
<td>Universal schooling</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Years of schooling</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Starting ages</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>National curriculum</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mainstream curriculum</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year level curriculum</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>International test success</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Style comparability</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 3: Number of criteria satisfied by curricula

The criteria do not in themselves determine a preferred list of comparison documents. New Zealand, for example, satisfies many criteria in the table, but may be a less satisfactory benchmark for both the general and the educational communities than, say Finland, which satisfies fewer criteria than any other curriculum. Hong Kong satisfies all criteria, but is not an appropriate comparison for English.

Because of this, the list of preferred comparison curricula below may appear somewhat idiosyncratic if viewed against the criteria, but is drawn from the discussion as a whole.

English recommendations

1. Ontario
2. New Zealand
3. England, Wales and Northern Ireland

The range of realistic choices for English is limited to countries with English as a first language. Ontario and New Zealand have advantages in being generally better performed internationally and Ontario has year-level statements that are easier to compare. New Zealand’s standards will have to be artificially linked to year levels (as was done with the Tasmanian curriculum in the Australian mapping) to enable the report to be written. The UK example may be preferred because the Key Stages are linked to specified year levels.
Mathematics recommendations

1. Singapore
2. Finland
3. Hong Kong

Singapore provides a strong comparison because of the country’s strong reputation in Mathematics and the fact that Mathematics is presented in year levels enabling easy comparison. A selection will need to be made of the secondary streamed curricula: it is proposed that the ‘O Level’ mathematics syllabus be used as the syllabus that leads on to further study. Finland, despite some difficulties in year alignments with Australia, is demonstrably the best performing nation internationally in Mathematics and Science, and has a very well articulated curriculum. Hong Kong’s curriculum is laid out in Key Stages, but units are allocated to year levels, so it is more easily comparable. Hong Kong also has a strong Mathematics reputation.

Science recommendations

1. Ontario
2. Finland
3. Singapore

Ontario aligns well with Australia, has a strong reputation in science and has a curriculum which is relatively easy to map. Finland, despite some difficulties in year alignments with Australia, is demonstrably the best performing nation internationally in Mathematics and Science, and has a very well articulated curriculum. Singapore’s Science curriculum is clearly strong but does not start until Primary 3 and has a streamed structure in the secondary years. Singapore does, however, perform exceptionally well in international tests.
Appendix 3: Porter source methodology

The methodology selected to address this task is based on an approach developed by Porter, Polikoff and Smithson, who established a ‘uniform language’ for describing curriculum content, which was then used to analyse and compare curriculum frameworks (the intended curriculum), classroom practice (the enacted curriculum) and assessment regimes (the assessed curriculum). The language can also be used to describe the content of assessment items, text-books and teaching materials.

The uniform language developed by the researchers involves two components:
- a language for describing in detail the knowledge base in each of English, science, history and mathematics; and
- a language for describing the ‘cognitive demand’ of each area, based on a hierarchy of performance expectations.

The first of these consists of lists of topics arranged in broad content categories in each subject domain. In English, for example, the topic group of ‘Language Study’ includes topics such as ‘spelling’ and ‘effects of race, gender or ethnicity on language and language use’. In Science, ‘ecosystems’ and ‘adaptation and variation’ appear as topics within ‘Ecology’. The lists of topics are intended to be complete and universal, so that they could be used to describe any curriculum in the relevant domain, regardless of year level, context or level of complexity.

The second category, ‘cognitive demand’, consists of descriptions of what students can do with particular knowledge. These descriptions are different for each learning area, though they are based on a similar hierarchy of demands consisting of five levels in categories like the following:
- memory and recall
- performing procedures
- communicating, demonstrating, explaining, creating
- analysis, argument and investigation
- evaluation and application in different contexts

Porter (2004: 3) argues that ‘the content language for an academic subject should be exhaustive in its inclusion of all possible types of content, and it should be common in the sense that the same language is used across studies and purposes’. He proposes that the terms used in the uniform language should have a common meaning to different people and over time.

The tool for analysis using these categories is a survey listing the knowledge base and cognitive demand applying to a subject area (eg English or mathematics). The strength of the surveys arises from the interaction of these two categories: respondents (usually curriculum developers or teachers) are asked to respond on a matrix that requires them to indicate whether, for example, a curriculum framework being considered includes:
- a specific topic;
- if so, to what extent; and
- at what level of cognitive demand students are expected to operate in relation to that topic.

A mathematics framework might, for example, include the expectation that a student will use a linear equation (the topic) to solve a novel problem (the cognitive demand). In English, a framework might require a student at one level to recall (cognitive demand) the difference...

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1 Porter (2002); Porter (2004)
between fact and opinion (the topic), while at a different level the requirement could be evaluate (cognitive demand) whether a writer has used facts and opinions (the topic) appropriately in a newspaper article. The topic in this example is the same in both cases (fact and opinion), but the cognitive demand is different. It is, therefore, in the intersections between the topic lists and the cognitive demands that the curriculum is described. Any curriculum is likely to include some but not all of the content topics for the field, and some curricula will be more comprehensive in their inclusion of topics. Any curriculum is likely to include a range of cognitive demands, and some will include a greater or lesser proportion of higher or lower cognitive demands.

Bibliography
APPENDIX 4: ACARA CURRICULUM MAPPING CALCULATIONS

Porter Graph

Step 1 Quality check of survey data
Perform following checks:
1. Ensure that a *Level of Coverage* cell is rated for all topics
2. Check that no more than one *Level of Coverage* cell is rated for each topic
3. Where *Level of Coverage* – None, ensure no *Expectation of Students* cell is rated for the topic

Step 2 Average *Level of Coverage* ratings
Where more than one survey has been completed for a domain/jurisdiction/phase of schooling, average *Level of Coverage* ratings for each topic across multiple surveys

Step 3 Sum weighted *Level of Coverage* ratings
Weight *Level of Coverage* ratings (weighted 1 X Slight Coverage, 2 x Moderate Coverage and 3 X Sustained Coverage) for each survey and add together to find total.

Step 3a Aggregate ACARA surveys to equal Phase of Schooling for comparison curriculum
Find maximum of *Level of Coverage* ratings for each topic across multiple year levels of National curriculum surveys
Find average of *Cognitive Demand* ratings for each topic across multiple year levels of National curriculum surveys

Step 4: *Level of coverage* %
For each topic, weight the *Level of Coverage* (1 X Slight Coverage, 2 x Moderate Coverage and 3 X Sustained Coverage) and divide by Total from Step 3

Step 5: *Average Cognitive Demand*
Where more than one survey has been completed for a domain/jurisdiction/phase of schooling, average *Cognitive Demand* ratings for each topic across multiple surveys

Step 6: *Total Cognitive Demand*
Sum of all Cognitive Demand ratings from Step 5.

Step 7: Calculate *Cognitive Demand* %
Cognitive demand cell/*Total Cognitive Demand* from Step 6

Step 8: *Cognitive Demand* % X *Level of Demand*%
For each cell, Level of coverage % x Cognitive Demand %

Step 9: Generate Graph
Use steps 1-8 for the expert mapping data and the teacher mapping data. Average the % coverage and the cognitive demand for the expert mapping data and the teacher mapping data and generate the graph.

**Topic Coverage Index**

Step 1: *Level of coverage* % for national and comparison curricula
Take *Level of coverage* % for National curriculum and selected combined comparison curriculum.
Step 2: Find absolute differences
Find absolute difference between Level of coverage % for national and Level of coverage % for the combined comparison curricula

Step 3: Calculate Coverage Index
For comparison of any two curricula,

\[ \text{Alignment Index} = 1 - \frac{\sum |X - Y|}{2} \]

Where \( X \) = ACARA Level of coverage %
\( Y \) = Comparison Combined Curriculum Level of coverage %

% of Curriculum devoted to Topic Group
Step 1: Sum Level of coverage % for all topics in each topic group for national curriculum
Sum Level of coverage % for all topics in each topic group for national curriculum.

Step 2: Sum Level of coverage % for all topics in each topic group for comparison combined curriculum
Sum Level of coverage % for all topics in each topic group for the comparison combined curriculum.

Step 3: Report
Report Level of coverage % for each topic group for national and the comparison combined curricula, or in cases where there is no data, the comparison curriculum documents.

% of Cognitive Demand
Step 1: Sum % Cognitive Demand for all topics in each topic group for national curriculum
For each cognitive demand, sum % Cognitive Demand for all topics in each topic group for national curriculum.

Step 2: Sum % Cognitive Demand for all topics in each topic group for comparison curriculum
For each cognitive demand, sum % Cognitive Demand for all topics in each topic group for comparison curriculum.

Step 3: Weighted Average Cognitive Demand for national curriculum
For each cognitive demand, average((Phase 1 Sum %Cognitive Demand x Phase years) + (Phase 1 Sum % Cognitive Demand x Phase years) + ... (Phase N Sum % Cognitive Demand x Phase years)) for national curriculum.

Step 4: Weighted Average Cognitive Demand for comparison curriculum
For each cognitive demand, average((Phase 1 Sum %Cognitive Demand x Phase years) + (Phase 1 Sum % Cognitive Demand x Phase years) + ... (Phase N Sum % Cognitive Demand x Phase years)) for comparison curriculum.