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Department of Education, Science and Training

YEAR 12 CURRICULUM CONTENT AND ACHIEVEMENT STANDARDS

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Scope of the study

This study provides the first Australia-wide picture of what is expected of students taking five subjects—English (including Literature), Mathematics, Chemistry, Physics and Australian History—in the final years of secondary school.

The study addresses three broad questions:

What is currently taught in these five subjects across Australia? This question is addressed through an analysis of the content of senior school curricula in the five subjects in all Australian states and territories. The study documents similarities and differences in approaches and in the content (subject matter and skills/understandings) emphasised in state and territory curriculum documents.

What is the 'essential' content (subject matter and skills/understandings) that all students *should* be acquiring through these subjects, regardless of the state or territory in which they live? This question is addressed by asking selected experts in the five subject areas to make judgments about existing and missing content in senior curricula.

What standard of performance is expected of students in these subjects, and how do these expectations vary across states and territories? This question is addressed through an analysis of state and territory descriptions of the highest grade (*eg*, *A*; Band 6; Very High Achievement) awarded in each subject.

Curriculum content: What is common?

The degree of curriculum consistency varies from subject to subject across Australia.

Physics and Chemistry are subjects with a very high degree of national curriculum consistency. Each state and territory offers subjects called Physics and Chemistry, and an analysis of the curriculum in these subjects shows that 85 to 95 per cent of curriculum content—both subject matter and intended skills/understandings—is common to all eight jurisdictions.

In Mathematics, 27 different TER courses are offered across Australia. Results in these courses/subjects can be used in the calculation of a student's Tertiary Entrance Rank.These courses are designed for different purposes and for students with different abilities and interests. Within these 27 courses, each state and territory offers a course that is identifiable as high-level mathematics. An analysis of these high-level mathematics curricula reveals a high degree of consistency across the eight jurisdictions. Approximately 90 per cent of the content of these high-level courses is common across states and territories.

Among more than twenty TER History courses on offer across Australia, only two are called 'Australian History'. Eleven of the twenty courses contain some Australian history, and there are three courses in Aboriginal studies that also contain some Australian history. In these fourteen courses, the subject matter (topics) of Australian history is generally embedded in a thematic or contextual approach. This means that it is not possible to identify specific topics (*eg*, particular historical periods) that all students are required to study across the country. Nevertheless, there is a moderate degree of consistency in the topics (*eg*, Federation) that teachers can choose as contexts for the in-depth study of

issues. Also, there is general agreement in all curriculum documents on the purposes of studying History at senior level, on the skills of historical inquiry that students are expected to develop, and on the approach to the study of History.

There are eighteen TER English courses on offer across Australia, not including courses in English as a Second Language (ESL). Four of these courses contain the word 'Literature' in their title. Commonality across states and territories can be found in the study of 'text types'. State and territory curriculum documents mention a total of fourteen different text types (*eg*, Poetry), and most jurisdictions require students to study some particular types of text. The study of novels and plays is required in all jurisdictions except Queensland, which suggests a balance across text types, but does not require the study of any one particular type.

Text types also provide a way of identifying where the study of literature is contained in senior English curricula apart from designated 'Literature courses'. For example, in Victoria, the English course requires that students study at least four texts from a selection of 13 types that include Poetry, Literature in Translation, Shakespearean Drama and Contemporary Literature. There is a high degree of agreement in state and territory documents on the skills and understandings that senior English courses are intended to develop. These range from 'using correct spelling, punctuation and grammar' to 'making meaning through texts'.

What students are required to study in English in the states and territories is not expressed in terms of topics. In some English courses there are set texts, in others there are set categories of text, and in others there is open choice. There are no specific texts that all Australian students are required to study.

Curriculum content: What is essential?

As well as analysing what is currently taught across Australia in these five senior subjects, this project also sought opinions on what *should* be taught in these subjects from selected experts (teachers, teacher-educators, university discipline specialists, and community members). These experts were asked to review and rate the importance of current curriculum content and to identify other content that they considered important but missing from current curricula.

In Physics, almost all topics identified as 'essential' by the majority of reviewers are present in all state and territory curricula. The only exception is the topic Static Electricity & Electronics, which was judged essential by the majority of reviewers but is not included in all state/territory curricula.

In Chemistry, the same topics appear in almost all state and territory documents and almost all were considered essential by the majority of reviewers. Two exceptions are Analytical Techniques and Gases in the Atmosphere, which appear in only some curricula. Analytical Techniques was rated 'essential' by almost all reviewers. On the other hand, while all states and territories include in their Chemistry curricula the historical development of atomic theory, none of the reviewers considered this topic essential.

In Mathematics, a list was developed of all topics covered in senior mathematics courses, and reviewers were asked to rate how essential each topic was for inclusion in the highest-level mathematics course. Almost all mathematics topics judged 'essential' by the reviewers appear in almost all state and territory highest-level mathematics curricula. The exceptions are The Binomial Theorem, Logic Proof, and Sequences and Series, which most reviewers considered 'essential' but are mentioned in a minority of advanced courses. (It is possible that, in some states, advanced mathematics students are exposed to these topics in other, complementary, mathematics courses). One topic—Application of Calculus to Conics—is mentioned in all advanced courses but was not considered essential by the majority of reviewers.

In Australian History, reviewers were less inclined than in Chemistry, Physics and Mathematics to identify specific topics as 'essential' for all students to study. There is no history topic that all reviewers considered essential to the senior curriculum. The topics considered most important are: The Nature and Impact of Immigration, Foreign Policy and Changing Relations, and The Social and Economic Impact of World War I. Reviewers were more inclined than for the other four subjects to identify additional topics that they believed students should study (*eg*, the Vietnam War and Protest).

In English, seven text types are mentioned in all state and territory documents as possible text types for student study. These seven text types also were considered by the reviewers to be the seven most essential text types for student study. Of these, Prose Fiction was judged most essential, followed by Contemporary Literature. A majority of reviewers considered Poetry essential. The other four text types mentioned in the top seven are Australian author/content, Film, Poetry, Drama/Play (the last-mentioned category being separate from Shakespearean Drama), and Prose non-Fiction. Most reviewers rated Shakespearean Drama 'desirable' but not 'essential'. Only a minority of reviewers rated the study of multimedia texts 'essential'.

Many of the English skills/understandings rated 'essential' by the reviewers appear in all state and territory English curricula. Rated most essential was 'communicating in writing', followed by 'understanding the role of context in text', 'understanding values, ideas and beliefs', and 'making meaning through texts'. The majority of reviewers considered good control of spoken and written English to be a crucial component of English courses. Some expressed the view that the senior English curriculum is not the only or best place for attention to linguistic accuracy; some described these as skills that should be developed in the earlier years of school; and some considered further instruction in these skills in the senior secondary years to be impractical because of time constraints.

Achievement standards: Are they comparable?

This study also considered the standards of achievement expected of students in each state and territory as reflected in jurisdictions' descriptions of what students must do to be awarded the highest possible grade (*eg*, Band 6 in New South Wales, Very High Achievement in Queensland). This analysis included an inspection of readily available assessment materials (school-based and externally set).

Across Australia, in all five subjects, there is a degree of consistency in what is looked for when assessing students' achievements. In any given subject, states and territories tend to pay attention to the same kinds of achievements and features of student work (*eg*, a student's ability to 'use evidence to support a point of view').

In Chemistry and Physics, there is a high degree of consistency in the kinds of achievements and features of student work that are assessed in the senior school, consistent with the high degree of commonality in Chemistry and Physics curriculum content.

In Mathematics, despite the commonality of curriculum content in high-level courses, there are some significant differences in what is required to achieve the highest available grade in advanced mathematics. Some jurisdictions require students to demonstrate mastery of a broader range of mathematical content; some appear to require higher levels of mathematical sophistication.

In Australian History, the assessed features of student work reflect the contextual approach to the teaching of this subject across Australia, meaning that what tend to be valued and assessed are students' skills of historical inquiry and critical analysis.

In English (including Literature), although all assessment regimes require students to demonstrate an understanding of texts and the ability to generate texts, there is considerable choice across the country in what those texts can be. There is no consistent explication of what jurisdictions assess in the subject English, although common words are used to describe requirements of student work if it is to be

awarded the highest available grade (*eg*, clear, critical, refined/sophisticated, complex, sustained/fluent, extensive, precise, skilful, insightful, detailed).

While it has been possible in most subjects to identify the kinds of achievements that states and territories value and assess (*ie*, what students are expected to be able to do), it has not been possible in this study to draw conclusions about relative performance expectations (*ie*, how well students are expected to do these things). For example, it has not been possible to judge whether an 'A' in Chemistry in Western Australia represents a higher or lower level of achievement than a 'VHA' in Chemistry in Queensland. Part of the reason for this is that the Australian states and territories use different terms to describe achievement expectations. Terms such as 'advanced', 'extensive' and 'outstanding' may have unambiguous meanings within particular jurisdictions, but these meanings are not shared across Australia. The comparison of state and territory achievement standards depends on an understanding of what is intended by statements such as 'demonstrates *advanced* use of the Newtonian model' in a particular jurisdiction. A comparison of achievement standards across Australia would require an analysis of the work that students must produce (including their responses to examination questions) to be awarded the highest available grade in each jurisdiction.

Questions raised by this study

This study has shown that, in some senior subjects such as Chemistry and Physics, there is already a very high degree of curriculum consistency across Australia. The selected experts asked to review the Chemistry and Physics curricula provided strong support for the current content of these subjects, while individually questioning the current relevance of some particular topics and proposing other topics that might be given more emphasis. Given that at least 85 per cent of the curriculum in these subjects is common across Australia, a question remains about the necessity and efficiency of developing curricula and their accompanying assessment processes for these subjects seven times in seven different jurisdictions (for use in eight jurisdictions). In these subjects, and perhaps others such as Economics, it should be a straightforward matter to reach Australia-wide agreement on a core of essential curriculum content (including both subject matter and essential skills/understandings).

A similar question can be asked about the need for 27 different TER mathematics courses across Australia. Different mathematics courses are required for students of different abilities and interests, but it is difficult to imagine that 27 different courses are necessary. Among the seven high-level mathematics courses—which go by a variety of names—there is a high degree of consistency of curriculum content, again suggesting that the identification of a core of essential content should be straightforward. The group of expert mathematics reviewers was supportive of current course content but felt that some essential topics were missing from some state curricula.

In Australian History, a question raised by this study is whether some topics (*eg*, historical periods) should be specified. The current approach is to emphasise the development of skills of historical inquiry in this phase of schooling, with teachers choosing the historical topics/themes (from recommended lists) within which to develop these skills. The assumption, no doubt, is that students have been exposed to major topics in Australian history in their earlier years of school. There is a question about the validity of this assumption. If topics were to be mandated, this group of history reviewers would give highest priority to The Nature and Impact of Immigration, and Foreign Policy and Changing Relations.

A similar question could be asked of English studies. Should every student taking English be required to study some specified text types or even specific texts? Presently, there is some consistency in views about the different *types* of text that students should study (supported by the group of English reviewers who gave highest priority to the study of Prose Fiction and Contemporary Literature), and a higher degree of consistency in views that the study of English should develop students' skills in: communicating in writing; understanding the role of context in text; understanding values, ideas and beliefs; and making meaning through texts. There is, however, very little consistency across Australia,

or indeed within jurisdictions, in *what* students are required to study. Indeed, subject English currently is perceived so differently in different states and territories that the jurisdictions differ in their description of language itself.

This study was not able to compare the standards of achievement expected of students in the different states and territories of Australia. While the study established significant consistency in *what* is assessed—and this is a prerequisite for meaningful comparisons—differences in terminology and the lack of access to students' assessment responses and work made it impossible to compare the standards required to achieve the highest available grade in each state and territory. An interesting question is whether access to examination responses and other student work in each jurisdiction would allow reliable comparisons of achievement standards. Different jurisdictions use different methods of assessment (*eg*, examinations, school-based tests and projects), raising a question as to whether achievement standards can be compared across jurisdictions, or whether the existence of different assessment methods confounds comparison.

Going forward on the basis of the study

On the basis of this study, we believe it would be desirable to:

1. identify, for each of some nominated senior school subjects, a curriculum 'core' that clearly specifies what all students in Australia taking that subject are expected to learn, regardless of where they live in Australia; and
2. develop a set of achievement standards as a nationally consistent description of how well students are expected to learn the core in each subject.

Curriculum 'core' in a subject could be expressed in terms of subject matter (*eg*, topics, text types, big ideas and concepts) and skills (both subject-specific and generic). It should:

- ensure sustained engagement with central concepts and principles in order to develop deep understanding;
- relate these central concepts to the world that students understand;
- express central concepts in language that is familiar to students;
- be developed to minimise overlap or duplication of core content across subjects;
- ensure the integration of academic content with the teaching and learning of higher-order thinking skills (ie, not privilege generic skills over conventional knowledge categories);
- require the development of factual (or declarative) knowledge. Students must learn facts, concepts and procedures and must be able to demonstrate and apply this knowledge (*eg*, to problems, performances); and
- respect domain-specific knowledge (*ie*, strike a balance between everyday relevance and application and more esoteric knowledge).

Curriculum documents should identify core content and standards in clear and precise language, even if the concepts (*eg*, in Atomic Theory) are not widely understood by the public. This does not necessarily mean avoiding technical and specialist terms: these are required for precise communication among teachers. A lack of clarity in curriculum documents sometimes arises from attempts to be inclusive and positive.

Terminology for describing the subject matter of the core curriculum should be consistent across Australia, there should be a common language for talking about theoretical and practical aspects of curriculum and assessment (including moderation), and common symbols should be used for codifying results on certificates.

Many people are involved in curriculum development in each of the jurisdictions. One of the reasons why the curriculum development cycle is so long is that it takes into account the nature of the subject itself, the needs of the individual student, and the requirements of society. The nature of a subject might change over time, the needs of one student are not the needs of another, and the requirements of society are not static. And it needs to be appreciated that curriculum authorities have to trade off what is needed/desired by the subject itself (as represented by the learned community), the individual student (as interpreted by others, not necessarily the student), society (as represented by the various stakeholders), and the nation (as articulated through government policy).

We can envisage ways of dealing with the quandary of deciding on core curriculum content and specifying national achievement standards other than by committee and/or the consensus of stakeholders. Possibilities that should be considered include the setting out of some principles and processes and/or the application of some empirical approaches.

An imperative in identifying a core of curriculum content is to ensure that it challenges students of all ability levels and backgrounds. This means that the core probably must be accessible at different levels to ensure that the highest-achieving students are challenged and the lowest-achieving students do not become disengaged. Teaching to the middle (*eg*, by stripping out intellectually imaginative and challenging work) does no favour either to high achievers or to marginalised students. Shakespeare's plays (for example) represent a significant piece of the literary canon for understanding contemporary problems encountered by high achievers and not-so-high achievers alike.

In some subjects, particularly English, there is a question as to whether teachers have been given too much choice about what to teach (*ie*, include or exclude). Where there is complete choice, perhaps one cannot be surprised if curriculum content degenerates into a lowest common (or populist) denominator.

While there are important issues to be resolved in relation to curriculum content for subjects such as English (including Literature), Mathematics, Physics, Chemistry and Australian History, there is a bigger issue at stake.

How many students across Australia actually take an English option that emphasises or even includes a study of literature and, in turn, exposes them to the canon? How many students across Australia develop an understanding of scientific concepts important to making decisions about real-world issues such as nuclear energy, genetically modified foods, water conservation, salinity, climate change and stem-cell research? How many students across Australia study History of any kind at senior level? How many students take highest-level Mathematics? How well are Australian students being prepared to contribute to national economic prosperity and to take their place as informed and engaged citizens in the twenty-first century?

Media reports sometimes criticise systems, schools and teachers for not producing the educational outcomes most valued by parents, employers, universities and the wider community. But have schools and teachers been given clear and unambiguous signals about exactly what is valued? If not, clear statements of core curriculum content and nationwide standards should assist.

The challenge as we see it is to set clear statements of core curriculum content within which schools and teachers have flexibility in relation to teaching strategies and learning contexts. An additional challenge is to set clear achievement standards which allow for different methods of assessment, but which provide comparable student results.

We can envision a future in which senior curricula are independently developed and managed across the states and territories, but with greater clarity in the language and symbols used to describe aspects of curriculum and assessment; greater consistency in curriculum arrangements, including the identification of a core of common curriculum content in selected senior subjects; and clearly stated achievement standards, which provide increased comparability of results on senior certificates.

Abbreviations and acronyms

ACACA	Australasian Curriculum Assessment Certification Authorities
ACE	Australian Certificate of Education
ACER	Australian Council for Educational Research
AST	ACT Scaling Test
DEST	(Commonwealth) Department of Education, Science and Training
ESL	English as a Second Language
HSC	Higher School Certificate
IB	International Baccalaureate
KLA	Key Learning Area
MCEETYA	Ministerial Council on Education, Employment, Training and Youth Affairs
NTCE	Northern Territory Certificate of Education
QSA	Queensland Studies Authority
SACE	(The) South Australian Certificate of Education
SOSE	Studies of Society and Environment
SSABSA	Senior Secondary Assessment Board of South Australia
TACE	Tasmanian Certificate of Education
TEE	Tertiary Entrance Examination
TER	Tertiary Entrance Rank
TQA	Tasmanian Qualifications Authority
VCAL	Victorian Certificate of Applied Learning
VCE	Victorian Certificate of Education
WACE	WA Certificate of Education

Chapter 1 – Background and scope

Context

Australia's six states and two territories all issue senior secondary certificates at the end of Year 12, the final year of schooling. The Senior Secondary Certificate of Education is referred to by local titles at the state and territory level as follows:

ACT *ACT Year 12 Certificate*[1]

NSW *Higher School Certificate* (HSC)

NT *Northern Territory Certificate of Education*[2] (NTCE)

QLD *Senior Certificate*[3][4]

SA *The South Australian Certificate of Education*[5] (SACE)

TAS *Tasmanian Certificate of Education*[6] (TCE)

VIC *Victorian Certificate of Education*[7] (VCE)

WA *WA Certificate of Education*[8] (WACE)

There are significant differences between jurisdictions in arrangements for curriculum, assessment and certification. There are differences in the number and types of subject that are offered, assessed and certificated; differences in assessment methodologies (external examinations, school-based assessments, scaling tests) for compiling final results for reporting on certificates at the end of Year 12 and in standards underpinning those assessments; and differences in the codes used to report results (numeric, letter-grades). There are also differences in procedures for ensuring comparability of standards in reported results (social moderation, statistical moderation) and in procedures for combining results from subjects in compiling tertiary entrance ranks.

These differences (and many of the others that exist) are grounded in the history of the states and territories and their education systems, and in the different sets of compromises that have had to be struck by curriculum and assessment agencies with their respective stakeholders over the years.

The Australian Government recently investigated the introduction of a single Australian Certificate of Education in pursuit of greater consistency in senior secondary arrangements for curriculum,

[1] Also a separate *Tertiary Entrance Statement*

[2] Based on procedures of the Senior Secondary Assessment Board of South Australia (SSABSA)

[3] To be replaced by the *Queensland Certificate of Education* in 2008

[4] Also a separate Tertiary Entrance Statement

[5] Report of SACE Review (*Success for all*), 2006

[6] Also a separate *Tertiary Entrance Statement*

[7] Plus the Victorian Certificate of Applied Learning (VCAL)

[8] To be replaced by the new WACE by 2009

assessment and certification, more comparable student results across jurisdictions, and clearer and more consistent standards of student achievement.

In a country with a relatively small and homogenous population, it is difficult to argue with the rationale for national consistency; namely, to:

- reduce difficulties for students moving between states and territories;
- assist national reporting on student learning outcomes;
- identify essential learnings that prepare students for an Australian and global society;
- utilise to the maximum effect scarce curriculum resources;
- meet the expectations of employers;
- assist universities to develop teacher programs that are appropriate to all Australian students;
- reduce the new learning required of teachers who move between jurisdictions;
- stimulate the development of high-quality resources to support implementation;
- enable the articulation (and marketing) of what distinguishes Australian education.

It should be noted that the call for *greater consistency* (in arrangements for curriculum, assessment and certification/reporting), *increased comparability* (in results that are recorded on certificates), and *clearly stated achievement standards* (for application nationwide) does not necessarily imply the need for a national curriculum or common national subject examinations. But it should also be noted that the achievement of greater consistency, comparability and clarity in these areas is inevitably more difficult if the underlying certificates, curriculum and assessment programs are independently developed and managed. Attempts to achieve similar goals in a developed management framework (eg, the assessment of student achievement against common literacy and numeracy benchmarks using state-based tests) have proved relatively ineffective.

During 2005, the Australian Government engaged the Australian Council for Educational Research (ACER) to investigate options for a single Australian Certificate of Education (ACE). ACER's report, entitled *An Australian Certificate of Education: Exploring a way forward* (hereafter referred to as 'The ACE Report') was released by the Minister for Education, Science and Training in May 2006. One of the inconsistencies highlighted in that report is in the way student results appear on formal documents.

Australian parents might be told by their 17-year-old child that s/he received a final mark of 19 for English. How they respond to this information would depend on where they live. In New South Wales, marks are reported out of 100, which makes 19 a very low score. In Victoria, the maximum possible score is 50. In South Australia, marks are reported out of 20, so 19 is definitely worth celebrating. Most other places do not report marks at all. Some (the ACT and Western Australia) use A to E grades. Others report results as achievement levels such as 'Sound' (Queensland) and 'Commendable' (Tasmania).

The confusion for many parents and employers is of the same ilk as that experienced when, as international travellers, they change currency on crossing a border. But it is even more complicated than that. It is a relatively simple matter to convert US dollars to English pounds or to convert Japanese Yen to South African Rand because official exchange rates operate throughout the world. But presently there is no way of comparing Year 12 results across state/territory boundaries: No official 'exchange rate' applies to school results. So nobody knows whether a score of 80/100 in Accounting in NSW represents a greater or lesser achievement in the knowledge and skills of Accounting than does a score of 40/50 in Victoria, or how either of these compares to an 'exceptional' result in Tasmania or 'very high' achievement in Queensland.

And the situation is becoming even more complicated. With proposed changes in a number of jurisdictions, including Queensland, South Australia and Western Australia, senior secondary arrangements in this country are about to diverge further. With a population less than that of some

American states, Australia now has nine[9] different senior secondary certificates (ten if the International Baccalaureate (IB) Diploma is included). Across the country there are bewildering variations in terminology for the elements on the certificate, in requirements that make it harder to be eligible to receive a senior certificate in some states/territories than in others, and as many different schemes for reporting final Year 12 results as there are agencies responsible for doing this.

This is how Year 12 results are currently reported on certificates:

ACT	One of five grades represented by the letters E, D, C, B, A; derived from school-assigned marks (mean 70, standard deviation 12)
New South Wales	One of six bands (Band 1, Band 2, Band 3, Band 4, Band 5, Band 6); derived from marks attained out of 100
Northern Territory	As for South Australia
Queensland	One of five achievement levels (Very Limited, Limited, Sound, High, Very High) represented as VLA, LA, SA, HA, VHA; based on subject-specific standards descriptors
South Australia	One of five grades represented by the letters E, D, C, B, A, derived from a score out of 20. Proposed for the future – 7 levels (not yet achieved, E, D, C, B, A, A^+)
Tasmania	One of five achievement levels (Preliminary, Satisfactory, Commendable, High, Exceptional) represented as PA, SA, CA, HA, EA
Victoria	A score out of 50
Western Australia	One of five grades represented by the letters E, D, C, B, A. Proposed for the future – a level (3, 4, 5, 6, 7, 8) and a band (first/medium/high) within that level

This situation stands in stark contrast to the situation in continental Europe where the countries in the European Union are collaborating to enhance the compatibility and comparability of their educational qualifications. The aim is to increase the international competitiveness of European education, to promote mutual recognition of qualifications across borders of member states, and to facilitate student mobility. Under the so-called Bologna Process, considerable progress has been made towards the development of more consistent higher education arrangements and qualifications.

The July 2006 meeting of the Commonwealth, State and Territory ministers of education decided to establish a working party to examine the feasibility of a common scale for reporting all senior secondary subject results. As a useful and welcome by-product, this development might be able to produce a common language for recording Year 12 results on certificates.

The bigger challenge, however, is to ensure that the 'top grade' in whatever language (code) it is expressed (eg, *A*) is assigned to student work of equivalent standard across the country. It should be equally challenging for a student to obtain a grade of *A* in the highest-level mathematics subject in New South Wales as it is in Western Australia. This degree of consistency requires agreement on what students in every state and territory must know and be able to do, and how well, to be assigned an *A* grade. This highlights the need for a common currency for giving value to student achievement for reporting purposes.

The value of an equivalent grade in a subject, however, depends on the degree of similarity of courses across Australia. Unless students are taught Chemistry, for example, in similar depth, with similar academic rigour, and underpinned by similar standards for students to aspire to, any attempt to compare grades or marks across the country is likely to be meaningless.

[9] The eight listed at the beginning of this chapter, one for each jurisdiction, plus an extra one, the VCAL in Victoria

To what extent are students in different states and territories required to learn the same facts, principles and skills in a given subject, say Physics? Is there a body of fundamental knowledge and ideas to which all students taking Physics should be exposed, regardless of where they live in Australia? Questions such as these have not been addressed in any systematic way. The time has come, therefore, to undertake this present study, which will contribute significantly to the process of identifying national curriculum essentials and achievement standards in senior school subjects.

The ACE Report contains six recommendations. The first recommendation is that 'curriculum essentials' be identified—initially in some nominated mathematics, English, science and social science/humanities subjects—to ensure that all Australian students have opportunities to engage with the fundamental knowledge, principles and ideas that make up those subjects. The second recommendation is that 'achievement standards' (described and illustrated levels of achievement) be developed to make students' results in these subjects more comparable across Australia. Recommendations 1 and 2 of The ACE Report led to this present study.

In June 2006, the Australian Government commissioned ACER to undertake an examination of five senior secondary subjects—English (including Literature), Mathematics, Physics, Chemistry, and Australian History—and, for each of these subjects, to answer the following questions:

What is currently offered in syllabuses/curriculum frameworks across the country?

What is considered to be essential for all students studying those subjects?

What standard are students currently required to attain across the country to be awarded the highest available grade in each of those subjects?

The first of these questions requires an analysis of what is currently included in senior school English (including Literature), Mathematics, Physics, Chemistry, and Australian History courses. This analysis will identify common content and approaches across Australian states and territories and also will identify ways in which curricula in these subjects currently differ. The investigation will reveal whether existing curricula in these subjects are sufficiently similar to permit the kind of consistency in reporting that the education ministers are seeking.

The second question requires a consideration of what *should* be taught in these five subjects. This is a matter of expert judgment. What is the 'essential' content that all students studying these subjects should learn, regardless of the state or territory in which they live? On this question there will be differences of opinion and vigorous debate, as there should be in relation to curriculum matters within a democracy. The identification of what is essential will set the stage for decisions about core curriculum; that is, the specification of mandatory content areas for study and mandatory skills.

The third question requires a consideration of the standard of achievement expected of students. What do students have to know and be able to do and how well to be awarded the highest possible grade in the subject? This investigation will provide an indication of standards in five subjects and their degree of consistency across jurisdictions.

Project objectives

The specific objectives provided for this project were to:

1. examine and describe curricula/syllabuses for each of the five Year 12 subjects (including options) including their content and standards;
2. identify and describe the nature and extent of the involvement of university discipline specialists in the development of content, curriculum and assessment criteria;
3. identify any correlation between the level of the options available in the subjects in question and the TER, or equivalent, score awarded;

4. analyse the distinctions among English (including Literature), Mathematics, Physics, Chemistry, and Australian History offerings in terms of content, curriculum and standards; analyse the range of options available within each subjects; and quantify the uptake of various options;
5. consider/collect views on desirable curriculum content in English (including Literature), Mathematics, Physics, Chemistry, and Australian History, and evaluate existing content in these five subjects.

Activities undertaken

The following main activities were undertaken:

- Desk analysis of readily available documentation about existing subject options in the five nominated subject areas, with specific reference to subject rationale, domains of learning, curriculum content, assessment requirements, moderation procedures, and expected achievement standards;
- Mapping of curriculum content in Physics, Chemistry, Mathematics, Australian History, and English across the country;
- Survey of reviewers' opinions about identified common curriculum topics and skills in terms of what curriculum content is considered to be essential;
- Analysis of comparability of achievement standards in each of Physics, Chemistry, Mathematics, English, and Australian History; and
- Provision of advice about a range of associated issues (eg, TERs and perceived advantage, personnel involved in syllabus development).

Report structure

The report on this study, *Year 12 Curriculum Content and Achievement Standards*, is divided into the following five main sections (plus end matter):

Chapter 1 – Background and scope

Chapter 2 – Curriculum content: What is common?

Chapter 3 – Curriculum content: What is essential?

Chapter 4 – Achievement standards: Are they comparable?

Chapter 5 – Conclusions: What is? What should be? What next?

Caveats

This section records nine limitations of the methodology in achieving the aims of the study.

1. Curriculum verification chain

This study is limited because a complete study of the curriculum would investigate the totality of the 'curriculum verification chain', which minimally consists of the following five stages[10]:

i. Intended curriculum
ii. Developed curriculum
iii. Enacted curriculum
iv. Assessed curriculum
v. Learnt curriculum

[10] The names of the stages are self-explanatory. Definitions are provided in the Glossary at end of this report.

This study reports on the content of the public documents issued by the states/territories to direct what students are to learn and how students are to be assessed. Thus the data in this study are confined to the 'intended' curriculum and aspects of the 'developed' and 'assessed' curriculum.

2. Emphasis on curriculum content

This study emphasises content; that is, the knowledge, skills and understandings that students are expected to acquire and the achievement of which is assessed. Describing and reporting curriculum content in terms of topics, themes and skills does not necessarily provide a complete understanding of the conceptual depth required of students. For example, a life-time of expert, specialist learning may be insufficient to gain a complete understanding of Physics concepts such as photons, forces and voltage. At the other extreme, the rote learning of a single sentence describing the concept 'photon' could be achieved in a single lesson.

3. Shared meaning of key terms

There is no universality of definitions. Mapping curriculum content around the country is based on the assumption that a topic in one jurisdiction has the same meaning and method of expression as it does in another jurisdiction. This is a problem because the meanings of words in curriculum/syllabus documents are, generally speaking, not fixed or common. Similarly, the comparison of achievement standards was limited by the difficulty of determining the precise meaning from jurisdiction to jurisdiction of terms used to describe assessment regimes, instruments, techniques, and criteria.

It is acknowledged that there is a school of thought that sees meanings as flexible, negotiated, and responsive to the changing nuances of practice. This may need to be debated/challenged.

4. Use of data from only one calendar year

This study uses data from only one calendar year, 2005, the most recent year for senior certification. Comprehending and collecting data from one particular year was necessary to ensure constancy in timing for the purposes of comparing the situation across the eight states/territories. Using the data from only one year limits the study to an analysis of extant policy and practice. This means that the study omits reference to some work under development.

5. Diversity in student population

The participation of students in post-compulsory schooling has increased substantially over the past 20 years or so. This has resulted in, or been a consequence of, changes in curriculum design to cater for the diversity of students remaining at school to Year 12. The changing nature of the student cohort might be responsible for complications encountered during this study in estimating participation and certification rates because it was difficult to ensure consistency in descriptions and classifications for key data items such as absolute numbers of certified results in specific courses (as opposed to numbers of students participating).

6. Diversity in curriculum offerings

In response to the increasingly diverse nature of the student population, jurisdictions have provided an increasingly diverse set of curriculum offerings.

For example, Mathematics is a highly differentiated subject: It is presented at different levels aimed at the needs and interests of different student groups. Not all Mathematics subjects on offer can count towards a TER. There is a similar situation for English, which is further complicated by (a) the distinction between language and literature, sometimes appearing together in one syllabus, sometimes in two separate syllabuses, and sometimes not identified in those terms (eg, the word communication often appears), and (b) the fact that English as a Second Language (ESL) is an important offering across the country.

This study has dealt with the diversity in curriculum offerings by ensuring that, where analyses are of the 'compare and contrast' kind, the same things are being compared/contrasted between jurisdictions and across the country.

All subject offerings under the banner of English (except ESL) and of Mathematics were covered in the mapping exercise. It was only feasible, however, to take forward for further analysis those subject options for which student results can count towards a TER. In studying achievement standards, in pursuit of optimal comparability across states/territories, only the highest-level Mathematics subjects were considered.

7. Minimal collaboration with curriculum/assessment authorities

This study is limited by a lack of cooperation of the ACACA[11] agencies (the consequence of a decision at the July 2006 MCEETYA meeting). This official lack of cooperation restricted the data available to the study, especially data for investigating achievement standards. A thorough study of what is rewarded in student learning for Year 12 across Australia would require access to this minimal list of additional data:

- actual assessment instruments and tasks;
- actual student assessment scripts; and
- actual marking schemes for all assessment tasks.

Only some of the information in the list above is in the public domain. The access route to other vital information not in the public domain would be through the corresponding ACACA agency. This was not possible. The issue of accessing student scripts is a separate issue, not related to the temporary lack of collaboration between ACER and ACACA—it is an issue of student anonymity and privacy acts.

The Queensland Studies Authority (QSA) granted ACER access to teacher-devised assessment materials as a response to the limitation described in 9 (iii).

The MCEETYA decision also prevented the usual process whereby ACACA agencies undertake a formal check on the accuracy of jurisdiction-specific primary data. Approaching ACACA agencies for the purposes of checking this information and summaries thereof was also seen as a courtesy to those agencies to ensure that there were no factual inaccuracies that would reflect on them.

8. Mapping and reviewing activities

Mapping of curriculum content and analyses of commonality took into account only explicit reference in curriculum documents to the various content areas. No inferences were made about what might be or could be, only what obviously is.

This study examined and described curriculum content and achievement standards for subjects for the senior certificate, which is issued to students on exit from Year 12. The publicly available curriculum documents do not necessarily delineate what is to be taught in Years 11 and 12. For example, statements relating to coverage over two years vary from defining the beginning of Year 12 as the last term of Year 11 to only stating what is to be taught over the combined two years to defining Years 11 and 12 as distinct stages. The extent to which Year 11 studies 'count' towards the final result (Band 6, VHA etc.) varies across the country. Sometimes the statements about achievement standards refer to the culmination of a spiral curriculum; sometimes they refer to the fullest and latest information from continuous assessment; sometimes they refer to a weighting of Years 11 and 12.

The categorisation of content areas within subjects, which was derived from the mapping exercise, was assumed as the basis for the reviewing exercise (ie, moving from common elements to essential elements). The reviewing exercise in turn required reviewers to answer questions about curriculum

[11] Australasian Curriculum Assessment Certification Authorities

content without consideration being given to pre- and post-Year 12 learnings (eg, Year 10 exposure and university pre-requisites).

9. Skewed volume of information as a function of dominant assessment regime

This study is limited by the volume of information that can be efficiently accessed and collated about the *application* of assessment standards to student work that is produced as a response to external examinations or school-based assessments. The volume of information available for study is a function of the dominant assessment regime. There are various reasons for this, and three of them are given.

The relative weighting of external examination results to school-based assessments varies across the country. Typical weightings are 70:30, 50:50, and 0:100, the last of these applying to the ACT and Queensland where there is no such thing as commonly applied examinations or assessment instruments.

In some systems where there are external examinations, the examination papers are publicly available (eg, HSC papers and associated marking schemes on the New South Wales Board of Studies website). In other systems where there are external examinations, papers must be purchased for viewing (eg, the Tertiary Entrance Examination (TEE) in Western Australia).

In systems where there is 100 per cent school-based (internal) assessment, the assessment programs (which, in Queensland, are centrally approved) are different from school to school. Therefore, assessment instruments and associated criteria/standards for marking cannot be obtained by visiting a website or paying a fee.

Thus, although prescribed learnings and assessment standards are in the public domain (they appear, more or less, in syllabuses and course framework documents), the instruments used to assess these learnings against those standards are not so easy to assemble.

Finally, this study is limited in that a rigorous analysis of the comparability of achievement standards across the country would require access to actual student work—an undertaking that would be expensive given the logistics involved and difficult in terms of inter-state relationships and potential threats that it might be perceived as presenting to teachers. It would also have to take into account many of the already-mentioned caveats, particularly those relating to subject differentiation and lack of a shared language for describing elements of curriculum and assessment.

In examining achievement standards in five subjects across eight jurisdictions on the basis of written documentation, only the standards that relate to the highest available grade in each jurisdiction are considered. And even for one standard this is quite a lengthy discussion. As well as the limitations of verbal descriptions (without instantiation of standards) for communicating standards, there is the added problem of the way the standards statements are written and applied across the country; for example, the way in which the minimum acceptable performance levels are not anchored to the same base level across the country.

Chapter 2 – Curriculum content: What is common?

Curriculum

The term *curriculum* has two major meanings. Simply stated, one is 'the stuff that kids learn'; the other is 'the whole experience of schooling'. The first of these, *curriculum as content*, refers to the selective traditions of knowledge and texts, skills and competences, processes and practices that education systems deem to be of value for transmission to, or construction by, successive generations of learners. The second, *curriculum as experience*, refers to the totality of students' learning experiences at school, including but not restricted to subjects taught, and knowledge and skills acquired.

Most generally, curriculum has to do with answers to such commonplace questions as: What can and should be taught to whom, when, and how? In particular, what can and should be taught to young Australians, in their final year of schooling, with what implications for pedagogy and engagement and sequence and breadth and depth and so on? Which is not unlike some of the questions posed in this study.

In practice, the products of curriculum/syllabus development appear to be the result of trade-offs between/among the needs/demands of the subject, the needs/demands of society, and the needs/demands of the individual student as well as settlements struck between the responsible authority and its stakeholders.

According to Marsh (2004), a curriculum framework or syllabus has two main purposes—control by the system and planning by teachers.

A syllabus typically includes the following components.

- rationale or platform
- broad goals and purposes
- guidelines for curriculum planning
- content
- guidelines for assessment
- information about pedagogy, learning and resources
- future developments for the area.

The rationale (or platform) for offering/studying a subject is of major importance because it is a statement of the values, principles and assumptions underpinning the syllabus's development and production. The rationale is often the amalgamation of government remit and subject-society input.

Curriculum documents are distinguished in terms of the nature of the curriculum organisers: The status quo has curriculum 'packaged' into subject areas (eg, Science) or subjects (Chemistry, Physics, Biology etc.). The *avant garde* has curriculum packaged in terms of generic skills or multidisciplinary repertoires of practice. Ideally, curriculum documents feature strong links between theory and practice. It is often the case that the way in which curriculum is organised/developed is a function of the pragmatic approach as in, for example, the national curriculum Years K–12 in England, and the eight Key Learning Areas (KLAs) for Years 1–10 in Australia.

In order to answer questions about what is currently offered in syllabuses/curriculum frameworks across the country, it was necessary to scan existing documentation for information about every state and territory, and analyse the information thus obtained.

Desk analysis

In collecting data for use in answering questions about *content and curriculum*, researchers in each subject area organised their analyses under the following headings:

- Subject rationale
- Domains of learning
- Course structure
- Curriculum content (including extension)
- Curriculum development.

And, for answering questions about achievement standards, these headings:

- Assessment requirements
- Moderation procedures
- Expected achievement standards
- Tertiary entrance ranking.

Researchers drew on a variety of information sources beginning with documentation available on the websites of the ACACA agencies and state departments of education. The ACACA CEOs were formally approached to supply names of suitable contact persons within the agency to respond to requests from the researchers for further information or clarification, with the understanding that there be minimal disruption to the core business of the agency. School authorities and other agencies (eg, tertiary admissions centres) were contacted as required.

Information collected through the desk analysis process about curriculum content in Physics, Chemistry, Mathematics, Australian History, and English (including Literature) in Australian states and territories was used as the basis for mapping similarities and differences in content, curriculum, and achievement standards across the country.

The analysis of achievement standards drew on information contained in curriculum documents and, if available, assessment instruments and associated marking schemes. For the majority of jurisdictions with external examinations it was possible to locate examination papers on the websites of the relevant ACACA agency. Examiners' reports were also available for some jurisdictions. In Queensland, where there is no external examination component in subject results, QSA granted permission to ACER to examine assessment instruments that had been devised by teachers, used in school assessment programs, and validated through the moderation process.

In this chapter, Chapter 2, we discuss the results of an analysis of what is currently offered in syllabuses/curriculum frameworks across the country. We discuss the results of an analysis of achievement standards later, in Chapter 4.

Mapping curriculum content

Two techniques were used for mapping: first, compiling tables to illustrate the overall picture; and, second, estimating the consistency of certain topics and skills across jurisdictions, sometimes accompanied by a discussion of comparisons/contrasts between jurisdictions. These techniques were applied subject by subject—Australian History, Physics, Chemistry, Mathematics, and English (including Literature).

1. Tables to illustrate the overall picture

Four tables were constructed for each subject area. These are presented in a set for each subject.

The first table (Table 1S) in the set for a given subject area (S) shows subject options on offer in each jurisdiction that includes a study of that subject area. The subject options were based on those identified in The ACE Report.

The second table (Table 2S) shows the current uptake of subject options identified in Table 1, expressed as the number of students and the percentage of the student cohort with certified results in that subject option. For comparison purposes, the data for analysis were obtained from records of certification in 2005.

The third table (Table 3S) shows the commonality of content across the country expressed in terms of frequency of occurrence of topics to be studied (and, where appropriate, sub-topics or themes). In obtaining information for Table 3, researchers studied the available information in the syllabuses of all jurisdictions and noted the topics that are not unique to any one jurisdiction; that is, that appeared in at least two of the syllabuses in use in Australia in 2005 (current version). Each of the topics was assigned to one of three commonality categories according to whether there was evidence in the curriculum documents that the topic (content area) was offered in at least two jurisdictions [*]; offered in several jurisdictions (up to 6 of the 8) [**]; offered in all or nearly all jurisdictions (7 or 8) [***].

This system of recording frequency of occurrence was used in preference to an exact count of the number of jurisdictions in which a topic appeared because of uncertainties arising from the use of different terminology in different jurisdictions. It was felt that the three broad categories provided a dependable picture without implying a level of precision that was difficult to confirm.

The fourth table (Table 4S) shows the commonality of *skills* made explicit in that subject's syllabus/curriculum framework. Within curriculum documents, curriculum packaging is described not only in terms of subject-specific knowledge (facts, concepts and procedures) but also in terms of dispositions, attitudes and skills developed through a study of the subject. Sometimes these skills are subject-specific; sometimes they are generic (across the curriculum). Researchers noted where there were explicit references in syllabuses to skills, dispositions and attitudes, and aggregated these references over the jurisdictions.

The tally takes account of instances of explicit mention of the skill[12] in the curriculum framework or syllabus document for TER courses in subject S. Absence of explicit mention does not necessarily prove that the skill is absent in the experienced curriculum. The maximum number of jurisdictions is seven given that the Northern Territory uses documents from South Australia.

The need for Table 4S emerged during the analysis and so the requirement for identification and description of specific topics and areas of study within each subject has been met in two ways: first, by

[12] The term *skill* is loosely used in this discussion to encompass the cognitive and affective domains.

analysing frequency of occurrence of topics and sub-topics (or themes) in curriculum documents; and, second, by analysing explicit references in syllabuses to skills, dispositions and/or attitudes.

2. Estimating consistency of topics/skills

The degree of consistency of topics and/or skills for each of the five subjects across jurisdictions was estimated, based on the primary data underpinning Tables 3S and 4S, and on the information gleaned about the work of high-achieving students (as discussed in Chapter 4). The degree of consistency is expressed as a percentage.

Results of the mapping exercise

As already mentioned, results from the mapping exercise are presented subject by subject. Individual states/territories are not identified. It is the nationwide situation that is summarised in the form of sets of tables.

Offerings, certification data, curriculum content and commonality

The five subjects under investigation are discussed in the following order.

1. Australian History
2. Physics
3. Chemistry
4. Mathematics
5. English (including Literature).

The results are presented in the following format for each subject (S) in turn.

- Table 1S: Subjects on offer that potentially include a study of S
- Table 2S: Certification data, S (or subjects including S), 2005
- Table 3S: Mapping of S content across Australia
- Table 4S: Skills made explicit in TER S courses
- Statement on degree of consistency of topics and skills/values.

Australian History

Results from the mapping exercise for Australian History are captured in Tables 1H to 4H.

Table 1H: Subjects on offer that potentially include a study of Australian history

NSW	TAS	QLD	VIC	SA/NT	WA	ACT
					History	History
		Ancient History				
Modern History		Modern History				
	Australian Studies		History: Australian History	Australian History	Australian Studies	
	Australia in Asia & the Pacific					
HSC History Extension						
Aboriginal Studies		Aboriginal & Torres Strait Islander Studies		Aboriginal Studies		

This table differs from the corresponding table in The ACE Report, which listed all History subjects. The table lists subjects that are called 'Australian History' and subjects that contain elements of Australian history. There are only two TER history courses called 'Australian History'. They are offered in South Australia and Victoria. Each jurisdiction, however, offers a TER-level History course that contains elements of *Australian* history. It is the courses identified in Table 1H that are taken forward in this study for analyses of curriculum content and achievement standards in Australian History. Topics within the courses in Table 1H range from a study of ancient Aboriginal civilisations to a study of the development of present-day foreign policy.

The 14 courses/subjects thus identified are listed below together with (in some cases) pertinent elements of the course/subject.

ACT History: 5 (out of 39 units offered): Australian History Research (half-semester only); Terra Australis Incognito; Contemporary Australia; Transition to Nationhood; Australia, a New Nation

NSW Aboriginal Studies

NSW Modern History: National study; personality in 20th Century

QLD Aboriginal & Torres Strait Islander Studies: 2 (out of 22 themes offered): Studies of archaeology; Continuity and change in Indigenous Australia

QLD Ancient History

QLD Modern History: 7 possibilities (out of 16 themes offered): Studies of conflict (eg, the frontier in Australia); Studies of diversity (eg, political movements in Australia); People and environments in history (eg, land use in Australia and its environmental impact); Local history (eg, impact of WW II on an area); The individual in history (eg, history of a local identity); National history (eg, establishment of Australia's foreign policy); History and historians (eg, the work of Manning Clark)

SA/NT Australian History (Stage 2)

SA/NT Aboriginal Studies

TAS Australian Studies

VIC Australian History (Units 3 & 4)

WA History E306: Australia in the Twentieth Century: Shaping a Nation (Unit 1)

Table 2H: Certification data, subjects including Australian History, 2005

Subject	NSW	TAS	QLD	VIC	SA/NT	WA	ACT
Modern History	9,996 (15%)		5,338 (13%)	–	–	–	–
Australian History/Studies	–	524 (11%)	–	1,580 (3%)	327 + 27 (2%), (3%)	–	–
History	–	–	–	–	–	2,902 (25%)	182 (5%)
Aboriginal Studies	246 (0.04%)	–	87 (0.2%)	–	117 + 34 (1%) (4%)	–	–
Ancient History	–	–	3,573 (9%)	–	–	–	–

The subject matter of Australian history is generally embedded in a thematic or contextual approach although the chronological approach is experienced by students in Victoria and Tasmania. A chronological approach is least evident in those jurisdictions with a thematic (or contextual) approach (Queensland and Western Australia). It may be an incorrect assumption that these jurisdictions do not have a chronological view; it may be the case that strong chronological 'building blocks' are laid in earlier years and that thematic approaches make use of this underpinning. Taylor's (2006) report on the teaching and learning of Australian history in schools, with a focus on the compulsory years, concludes that 'there is no guarantee that the vast majority of students in Australian schools will have progressed through a systematic study of Australian history by the end of Year 10. Indeed, the opposite is almost certainly the case. By the time they reach leaving age, most students in Australian schools will have experienced a fragmented, repetitive and incomplete picture of their national story'.

Many students in Australian schools would have experienced no picture of their national identity. The number of students studying any History subject at Year 12 is not large. The number of students encountering subject History rather that a 'strand' of a more general learning area such as Studies of Society and Environment (SOSE) at Year 10 and below is, for a number of reasons, minimal. It is not surprising then to find that the subject matter of Australian history across jurisdictions shows only a moderate degree of consistency in the topics (eg, Federation) that teachers can choose as contexts for the in-depth study of issues.

Where there is a large degree of choice allowed, some schools might choose to spend a term on the topic whereas others might spend only one lesson. Tallying the number of courses mentioning a given topic (say 'gold rushes') does not take into account the various ways in which such a topic can be treated (eg, by studying its social, political or economic implications). In both cases, however, because the topic is mentioned in curriculum documentation, it is included in the tally for Table 3H.

Table 3H: Mapping of Australian History content across Australia

	Topic	Frequency		
		*	**	***
1.	**Aboriginal culture/perspectives**			√
Theme	Social Justice	√		
	Relationship to land	√		
	Histories	√		
2.	**Federation**		√	
Theme	Developments (social/economic/political) that led to Federation	√		
	Ways that decisions made at Federation shaped the nation's future	√		
3.	**World War I**		√	
Theme	Social and economic impact on Australia as a new nation	√		
	Contemporary life in Australia	√		
4.	**The Great Depression**		√	
Theme	Social impact: How Australians responded	√		
5.	**World War II**			√
Theme	Causes and repercussions for Australia		√	
	Impact on Australian society	√		
6.	**Waves on immigration**			√
Theme	Effect on Indigenous people of European expansion/exploration	√		
	Nature and impact of immigration (eg, social/cultural changes)		√	
7.	**Foreign policy**		√	
Theme	Australia's changing relations with the wider world (chronological approach)	√		
	Refugee issues (post-WWII)	√		
8.	**Significant Australians**		√	
Theme	Study of a local hero	√		
	Study of a significant Australian of the 20th century	√		

The absence of explicit directions about depth of learning and time allocations for topics within a course is a recurring theme in this study. For example, the phenomenon of significant differences in conceptual depth is discussed in Chapter 4 (see achievement standards Physics).

On the other hand, it cannot be demonstrated that students do have the opportunity to acquire particular knowledge when they study a subject/course within which there is a wide range of content options and a focus on process.

In many cases the broad learning intentions are described in terms of the historical inquiry skills, attitudes and values that students should gain from undertaking the course. Table 4H captures some of these similarities.

Table 4H: Skills made explicit in TER 'Australian History' courses

Skill/Understanding/Value	No. of jurisdictions (out of 7 sets of documents)
Awareness of significant events/people	3
Understanding continuity and change, different interpretations of history, the role of values in history	5
Dealing with evidence; solving historical problems	6
Analysing documents; comparing/contrasting/threading	5
Critical analysis; literacy	6
Oral communication (history context)	4
Written communication (history context)	4
Understanding historical concepts and issues	5
Understanding uses and contributions of history	3

Note: No explicit mention of the skill in a curriculum document does not necessarily mean that it is absent from classroom teaching.

Commonality in Australian History

The estimated degree of consistency across the country in *topics* covered in Australian History is less than 50 per cent. The estimated degree of consistency in *skills* of historical inquiry is at least 75 per cent. In probability terms, only about one in every two young Australians who study Australian history would learn about the impact of World War II on Australian society or the social and economic impact on Australia as a new nation of World War I. At least 75 per cent of them learn to develop skills in evaluating sources, comparing different points of view about an historical event or person, and citing references.

There are some other areas of commonality: Definitions of history and the underpinning philosophies or rationales for studying it indicate a considerable level of agreement between jurisdictions. The fact that there is considerable agreement presents a conundrum: If the agreed-upon position amongst those responsible for curriculum development in each state/territory is similar across the country, is that sufficient justification for that view to prevail?

The extent to which common reference books are recommended across jurisdictions might provide a starting-point for investigating similarities in approaches to topics. Of the approximately 270 recommended readings in Australian history for three jurisdictions (ACT, Victoria and Western Australia), thirteen were common to two of those jurisdictions, and none to three jurisdictions. It is acknowledged that these are not prescribed texts and it is quite possible that teachers do not refer to them at all.

Physics

Results from the mapping exercise for Physics are captured in Tables 1P to 4P.

Table 1P: Subjects on offer that potentially include a study of Physics

NSW	TAS	QLD	VIC	SA/NT	WA	ACT
Physics	Physics	Physics	Physics	Physics	Physics	Physics
	Physical sciences				Physical Science	

Note: The subjects, Physical Sciences (TAS) and Physical Science (WA), are about the physical world, essentially a combined study of Physics and Chemistry.

Table 2P: Certification data, Physics, 2005

	NSW	TAS	QLD	VIC	SA/NT	WA	ACT
Physics	9,443 (15%)	329[13] (7%)	5,028[14] + 37[15] (13%)	6,758 (14%)	3,067 + 146 (28%)	3,021 (18%)	538 (13%)
Physical science(s)		1,290[16] (26%)				430 (2.5%)	
Total certificated	61,102	4,913	39,712	47,566	11,504	17,127	4,056

Note: Of the students who study Physical Sciences in Tasmania, usually in Year 11, some go on to Chemistry in Year 12, some to Physics, some to both, some to neither. It is a pre-tertiary subject. It is also of general interest and an endpoint in itself.

[13] Most Year 12
[14] Students with 4 semester units in externally moderated school-based assessment
[15] External examination candidates
[16] Most Year 11

Table 3P: Mapping of Physics content across Australia

	Topic	Frequency		
		*	**	***
1.	Newtonian mechanics			✓
	Force and motion			✓
	Energy and momentum			✓
	Gravitation			✓
2.	Waves			✓
	Electromagnetic waves			✓
	Photonics		✓	
	Sound		✓	
3.	Electromagnetism			✓
	Static electricity		✓	
	Current electricity			✓
	Electronics		✓	
	Magnetism			✓
4.	Astronomy/astrophysics	✓		
5.	Thermodynamics	✓		
6.	Atomic and nuclear physics			✓
	Radioactivity			✓
	Nuclear power			✓
	Interactions of light and matter			✓
7.	Special relativity	✓		
8.	Measurement			✓
	SI units			✓
	Uncertainty in measurement			✓
9.	Materials/structures	✓		

Table 4P: Skills made explicit in (TER) Physics courses

Skill/Understanding/Value	No. of jurisdictions (out of 7 sets of documents)
Experimental investigation	7
Quantitative problem solving	8
Use of mathematical models	8
Use of conceptual models	5
Practical work	2

Note: No explicit mention of the skill in a curriculum document does not necessarily mean that it is absent from classroom teaching.

Commonality in Physics

The estimated degree of consistency in the content of Physics at Year 12 across the country is at least 85 per cent. The sources of difference in curriculum content are in approaches to practical work and depth of conceptual understanding expected.

According to the documentation, some jurisdictions do not distinguish between what is studied at Year 11 and at Year 12. Where the distinction is made, topics that form part of the previous year's study and underpin Year 12 are not necessarily included in assessment in or at the end of Year 12. Consequently, there is even more in common for students after two years studying Physics than appears to be the case, possibly 90 per cent.

Chemistry

Results from the mapping exercise for Chemistry are captured in Tables 1C to 4C.

Table 1C: Subjects on offer that potentially include a study of Chemistry

NSW	TAS	QLD	VIC	SA/NT	WA	ACT
Chemistry	Chemistry	Chemistry	Chemistry	Chemistry	Chemistry	Chemistry
	Physical Sciences				Physical Science	

Note: The subjects, Physical Sciences (TAS) and Physical Science (WA), are about the physical world, essentially a combined study of Physics and Chemistry.

Table 2C: Certification data, Chemistry, 2005

	NSW	TAS	QLD	VIC	SA	NT	WA	ACT
Chemistry	10,116	515	8,183	8,897	2,241	202	3880	792
All students who were certified	61,102	4,913	39,712	47,566	11,504	923	17,127	4,056
% Chemistry	16.6%	10.5%	20.6%	18.7%	19.5%	21.9%	22.7%	19.5%

Note: Physical Sciences (TAS) is 1,290 (26.3%); Physical Science (WA) is 430 (2.5%). See extra notes in section above for Physics.

Table 3C: Mapping of Chemistry content across Australia

Content	Topic	Frequency		
		*	**	***
1.	**Atomic Structure**			✓
	Historical development of the atomic theory			✓
	Periodicity, periodic table			✓
	Chemical Bonding			✓
2.	**Structure of Materials**			✓
	Properties and uses of substances			✓
	Aqueous chemistry			✓
	Gases and the atmosphere			✓
3.	**Stoichiometry**			✓
4.	**Quantitative Chemistry**			✓
	Analytical techniques			✓
5.	**Reactions and equations**			✓
	Acid and bases			✓
6.	**Equilibrium**			✓
7.	**Thermochemistry**			✓
	Energy, enthalpy			✓
	Rates of reactions			✓
8.	**Electrochemistry**			✓
	Oxidation & reduction			✓
	Redox potentials			✓
	Faraday's Laws			✓
	Metal reactivity			✓
9.	**Organic Chemistry**			✓
	Nomenclature			✓
	Functional groups			✓
	Biochemistry			✓

Note: Many of these topics are studied in Year 11 are either assumed knowledge for Year 12 external examinations or counted in Year 12 results (fullest and latest policy) where there is internal assessment.

Table 4C: Skills made explicit in (TER) Chemistry courses

Skill/Understanding/Value	No. of jurisdictions (out of 7 sets of documents)
Understanding the methods of Chemistry	7
Communicating scientific ideas orally and in writing	7
Using the scientific method and experimentation	7
Considering applications to industry	7
Explaining natural processes	7

Note: No explicit mention of the skill in a curriculum document does not necessarily mean that it is absent from classroom teaching.

Commonality in Chemistry

The estimated degree of consistency in Year 12 Chemistry across the country is 95 per cent.

Mathematics

The results from the mapping exercise for Mathematics are captured in Tables 1M to 4M.

Table 1M: Subjects on offer that include a study of Mathematics

NSW	TAS	QLD	VIC	SA/NT	WA	ACT
General Mathematics	Mathematics Applied Senior Secondary 5C	Philosophy and Reason (previously Logic)	Further Mathematics Units 3 and 4	Mathematical Applications	Discrete Mathematics	Trade and Business Mathematics (A)
Mathematics (previously 2-Unit M)	Mathematics Methods Senior Secondary 5C	Mathematics A	Mathematical Methods Units 3 and 4	Mathematical Methods	Modelling with Mathematics	Mathematics Applications (T)
Mathematics plus Mathematics Extension 1 (previously 3-Unit M)	Mathematics Specialised Senior Secondary 5C	Mathematics B	Mathematical Methods (CAS) Units 3 and 4	Mathematical Studies	Applicable Mathematics	Mathematics methods (T)
Mathematics plus Mathematics Extension 1 plus Mathematics Extension 2 (previously 4-Unit M)		Mathematics C	Specialist Mathematics Units 3 and 4	Specialist Mathematics	Calculus	Specialist Mathematics (T)

Note 1: Year 12 courses only

Note 2: NSW shows courses in terms of a collection of subjects. For example, the course formerly called 4-Unit Mathematics is now defined as the collection of three subjects in the bottom row of the first column. In all other jurisdictions a course may consist of one or more subjects as listed.

Note 3: 'A' courses in the ACT are 'appropriate for students in Year 11 and Year 12': 'T' courses are 'to prepare students for higher education'.

The following information is necessary pre-reading to Table 2M (Certification data, Mathematics, 2005).

Categorisation of Year 12 mathematics courses that lead to tertiary study

The Year 12 courses that lead to tertiary study can be reasonably well classified into three broad categories. In order to distinguish these categories from any of several classification schemes applied in this country and elsewhere, they are labelled as alpha, beta and gamma according to what mathematics content is considered to be a requirement for the variety of available tertiary courses. All three Year 12 courses have pre-requisite courses at Year 11.

Alpha courses emphasise practical applications and provide a sufficient basis for tertiary courses in areas such as the arts, agriculture, building construction.

Beta courses are suitable for students intending to study tertiary courses with some mathematics content, such as accounting, commerce, health sciences, and psychology.

Gamma courses provide the mathematics needed for tertiary courses such as engineering, computer science, physical sciences, and mathematics.

Students who aim to maximise their study of mathematics might do a beta course and a gamma course together. (In New South Wales the courses are already combined: the beta course includes the alpha course and the gamma course includes the beta course.)

The analysis of achievement standards (see Chapter 4) takes this categorisation further, introducing sigma courses into the discourse. Finding frameworks for discussing what is common and what is essential in subject Mathematics proved to be one of the biggest challenges in preparing this report, not only because of the status of Mathematics in the curriculum but also because of the myriad ways in which the subject is constituted for the needs of different groups of students with different abilities and interests. The proliferation of mathematics options within jurisdictions has been a response to the challenge of increased diversity in the nature of the cohort remaining at school until the end of Year 12. There are 27 different TER courses in Mathematics on offer across Australia. Some of these courses are identifiably highest-level Mathematics. Others are identifiable universally as *the* subject Mathematics (although not at the very highest level) and some others are of the mathematics-in-society genre with more emphasis on everyday applications such as finance.

The table below shows how the courses offered by the jurisdictions fit these categories. Each course is typically two semester units (each about 50–60 hours). The Tasmanian courses and M Studies in South Australia/Northern Territory are of 150 hours' duration, and each extension in New South Wales adds 50–60 hours.

Categorisation of Year 12 mathematics courses that lead to tertiary study

	Alpha	Beta	Gamma
ACT	M Applications	M Methods	Specialist M
QLD	M A	M B	M C
NSW	General M	M M plus M Extension 1	M plus M Extension 1 plus M Extension 2
SA/NT	M Applications	M Methods M Studies	Specialist M
TAS	M Applied	M Methods	M Specialised
VIC	Further M	M Methods M Methods (CAS)	Specialist M
WA	Discrete M (Modelling with M)	(Modelling with M) Applicable M	Calculus

Table 2M: Certification data, Mathematics, 2005

Course with highest enrolment in category	NSW	TAS	QLD	VIC	SA	NT	WA	ACT
Philosophy & Reason	–	–	305* (0.8%)	–	–	–	–	–
Alpha	28,917* (47.3%)	1,341 (27.3%)	21,565* (54.3%)	22,501 (47.3%)	3,278	395	6,519 (38.1%)	1,497 (36.9%)
Beta	19,340* (31.6%)	796 (16.2%)	16,534* (41.6%)	16,746 (35.2%)	3,291	1,497	4,514 (26.4%)	846 (20.9%)
Gamma	3,313* (5.4%)	211 (4.3%)	3,317* (8.3%)	5,627 (11.8%)	1,122	520	1,601 (9.3%)	439 (10.8%)
Total no. of students	61,102	4,913	39,712	47,566	11,504/ 16,658	923/1,520	17,127	4,056

Note 1: NSW and QLD: * shows enrolments rather than completions

Note 2: In VIC, course numbers are for satisfactory completion of Unit 4

Note 3: In WA, course numbers are those sitting the TEE

Note 4: In ACT, numbers are from ACT BSSS Table 10.2 with students from international schools not included

Note 5: Percentages not reconciled for SA/NT

Table 3M: Mapping of Mathematics content across Australia [all course categories]

	Topic	Frequency		
		*	**	***
1.	Statistics/Data Analysis/Univariate and Bivariate data [alpha courses]			✓
2.	Financial Applications/Business Maths [alpha courses]			✓
3.	Geometry/Applied Geometry [alpha courses]		✓	
4.	Probability [alpha courses]		✓	
5.	Optimisation/Networks [alpha courses]		✓	
6.	Operations Research [alpha courses]	✓		
7.	Modelling/Algebraic modelling [alpha courses]		✓	
8.	Matrices [alpha courses]	✓		
9.	Matrices/(Matrices and) Vectors/Linear Equations [beta or gamma courses]			✓
10.	Probability and Statistics [beta or gamma courses]		✓	
11.	Functions/Functions & Relations/Functions & Graphs/Algebra of Functions [beta or gamma courses]			✓
12.	Sequences and Series [beta or gamma courses]	✓		
13.	Logic and Proof/Induction [beta or gamma courses]	✓		
14.	Calculus/Differential Calculus/Integral Calculus [beta or gamma courses]			✓
15.	Calculus Applications – Rates of Change, Differential Equations, Conics [beta or gamma courses]			✓
16.	Polynomials/The Binomial Theorem [gamma courses]	✓		
17.	Complex Numbers [gamma courses]			✓

Table 4M: Skills made explicit in TER Mathematics courses

Process/skill	No. of jurisdictions (out of 7 sets of documents)
Problem solving, justification/communication	7
Mathematical modelling	7

Note: No explicit mention of the skill in a curriculum document does not necessarily mean that it is absent from classroom teaching.

Use of calculators

A supplementary question to Specific Objective No. 1 required information on the extent to which graphics or algebra calculators are used.

The following information was extracted from a recent report (Coupland, 2006).

Queensland mathematics syllabuses include statements about expected levels of access to appropriate technology. This varies from not requiring continuous access (Mathematics A) to stating that a minimum requirement is access to a graphing calculator (Mathematics C). This issue is linked to the nature of assessment tasks. Where the teaching and learning of a topic is enhanced by the opportunities

for exploration and for investigating real-world data that computers and graphing calculators allow, students in Queensland are expected to use this technology (Coupland, 2006).

Graphing calculators are widely used in all Victorian mathematics subjects. In external HSC examinations in New South Wales, graphing calculators have been optional for the subject General Mathematics in recent years. The use of scientific calculators is assumed in New South Wales HSC examinations for other subjects. It is generally agreed that the rules about access to technology in high-stakes external assessment have a significant effect on the use of such technology in teaching and learning.

The move towards CAS enabled technology in Victoria for the Calculus-based subjects (Mathematics Methods Year 23, Units 3 and 4) has no equivalent in New South Wales. In Victoria, examiners were initially directed to assume that students have access to an approved CAS for Examination 2 in Mathematics Methods and Specialist Mathematics examinations for 2009. In a later Bulletin, this date was changed to 2010 to allow schools more time to prepare for the changes.

In Queensland and the ACT, students are expected to use technology appropriate to the mathematical task being undertaken. All assessment concerning mathematics achievement is conducted internally, and moderated externally. The Queensland Core Skills (QCS) Test and the ACT Scaling Test are standardised tests used to scale internal assessments for the purpose of compiling tertiary entrance ranks. The QCS Test allows students to bring to the test their 'tools of the trade', which includes programmable calculators.

In the remaining states that conduct external examinations, the use of graphing calculators is widely assumed (Barrington and Brown, 2005). An interesting exception to this pattern is the decision in Victoria to have the external assessment for the Calculus-based subjects Mathematics Methods Units 3 & 4, Mathematics Methods Units 3 & 4 (CAS), and Specialist Mathematics on two examinations, one to be a one-hour technology-free paper.

Commonality in Mathematics

The estimated degree of consistency in Mathematics content across the country is 90 per cent. There are only small differences between jurisdictions in courses designed to lead to university study. These courses would be recognised anywhere in the world as obviously being the academic subject Mathematics. They cover mathematics concepts, facts and skills that are considered appropriate for university courses with mathematics prerequisites.

The greatest differences can be found in courses that are of the social mathematics or mathematics-for-living variety, but which can also provide mathematics that is suitable for those tertiary studies without specified prerequisites in mathematic as well as serving its primary function of developing mathematical literacy. Even for these courses the degree of consistency appears to be in the vicinity of 75 per cent.

English (including Literature)

Table 1E: Subjects on offer that include a study of English

NSW	TAS	QLD	VIC	SA/NT	WA	ACT
English (Advanced)	English Studies	Senior English	English	English Studies	Year 12 English	English T
English (Standard)						
			Literature		English Literature	World Literature T
English Extension Course 1		English Extension (Literature)				
English Extension Course 2						
	English Communications			English Communications		
	English Writing					
			English Language			
					Senior English	English A
					Vocational English	
ESL	ESL		ESL	ESL	ESL	ESL T
				ESL Studies		ESL A

Table 2E: Certification data, English, 2005

	NSW	TAS	QLD	VIC	SA	NT	WA	ACT
English	English (Advanced), 27,688 (45.3%) English (Standard) 30,508 (49.9%)	English Studies 665 (13.5%) English Writing 606 (12.3%)	Senior English 33,585 (84.6%)	English (Unit 4) 41,772 (87.8%)	English Studies 2,322 (20.2%)	English Studies 324 (35.1%)	Year 12 English 8,879 (51.8%)	English T 2,956 (72.9%)
English Communi-cations		English Communications 1,970 (40.1%)			English Communications 6,608 (57.4%)	English Communications 596 (64.6%)		
English Literature/ Extension	English Extension 1 6,362 (10.4%) English Extension 2 2,647 (4.3%)		English Extension (Literature) 531 (1.3%)	Literature (Unit 4) 5619 (11.8%) English Language (Unit 4) 1,421 (3%)			English Literature 1,883 (11%)	World Literature T (included in English)
Non-TER Y12 English							Senior English 6,462 (37.7%) Vocational English 2,039 (11.9%)	English A 736 (18.1%)
English as a Second Language (ESL)	ESL 3,008 (4.9%)	ESL 170 (3.5%)		English (ESL) (Unit 4) 3,324 (7%)	ESL 237 (2.1%) ESL Studies 739 (6.4%)	ESL 64 (6.9%) ESL Studies 48 (5.2%)	ESL 899 (5.2%)	ESL T 182 (4.5%) ESL A 40 (1%)
Totals	HSCs awarded[17] 61,102	Students receiving TCE[18] 4,913	Senior Certificates 39,712	VCE completion[19] 47 566	SACE completion[20] 11,504	SACE completion 923	WACE completion[21] 17,127	ACT Y12 certificated 4,056

The format for describing content areas in English (including Literature) across the country is different from that provided for the four other subjects. What is intended for study in English curricula is typically not expressed in terms of content area or topic. For the purposes of comparing jurisdictions, researchers in this project identified text types as an appropriate mechanism for expressing what is intended for study. Table 3E maps English content across Australia in terms of text type. There are notes to assist the reader interpret this table.

[17] To fulfil the requirements for the HSC, students complete one Preliminary course and one HSC course from: • English (Standard) • English (Advanced) • ESL.

[18] The TCE is a record of student achievement in TCE senior secondary syllabuses, issued to students when they leave secondary education at any stage during Year 11 or 12. It can record all senior secondary students' learning in: • subjects assessed under TCE senior secondary syllabuses 2-5; • TQA accredited courses; • nationally recognised Vocational Education and Training Certificates and competencies; • TQA recognised courses; and • school developed courses.

[19] Requirements for VCE eligibility: Satisfactory completion of 16 units, including 3 units from the English group, with at least one unit at Unit 3 or 4 levels. • Three sequences of Units 3 and 4 studies other than English, including VCE VET Units 3 and 4 sequences.

[20] To fulfil the SACE requirements, a student must record achievement in 2 units of Stage 1 English or English as a Second Language or Communication for the Hearing-impaired. The 2 units do not have to be taken in the same year. Stage 1 English may be taken as either a 1-unit or a 2-unit subject.

[21] The WACE requires English language competence, which may be provided by a grade of C or better in any of the English courses listed in this table.

Table 3E: Mapping of English content across Australia

(For notes to assist interpretation, see next page.)

Text types	Examples	NSW	NSW	QLD	QLD	TAS	TAS	SA	SA	VIC	WA	WA	ACT
		Standard	Advanced	English	Ext	Comm.	Studies	Comm.	Studies	English	English	Eng Lit	Course
		P	P	S	#	P	P	N	P	P	S	P	S
Required number		≥4	≥5	N		≥3	≥5	≥3	≥6	≥4	≥4	≥6	
Prose fiction	Novel	1	1	o		1	1	1	1	1	1	1	m
	Short story collection	1	1	o		1		1		1	x	1	m
Poetry		2	2	o			x	2	2	x		2	m
Song				o		x				x			m
Prose non-fiction	Expository	3	3	o		1		1		x	x		m
	Biography	3	3	o		1	x	1	x	x	x		m
	Autobiography	3	3	o			x		x	x	x		m
Media/multimedia		3	3	o		2				x			m
Drama/play		4	4	o		1	2	3	3	x	2	3	m
Film/play scripts		x	x	o				3	x	x	x	x	m
Film		4	4	o		2	3	4	4	x	3		m
Documentary				o		2				x	4		m
Shakespearean drama		x	5	o			x		x	x	x	x	m
Contemporary lit.		x	x	o		x	x	x	x	x	x	x	m
Lit. in translation		x	x	o			x		x	x	x	x	m
Historical texts		x	x	o			x		x	x	x	x	m
Aust. author/content		x	x	o		x	4	x	x	2	x	x	m

Legend for Table 3E

P:	Prescribed text list	x:	Text type is in list of prescribed texts
S:	Suggested text list	o:	Specified in syllabus but not part of a prescribed list
N:	No set text list	m:	May be studied, depending on unit/course content
1, 2, 3, 4, 5:	Five categories of mandated text type	#:	This subject is discussed in detail in Chapter 4.

Notes to assist interpretation of Table 3E

Looking at one state:

English Literature in Western Australia has a list of prescribed texts. Students must study at least six extended texts, which must include texts from categories 1, 2 and 3 (specifically a novel, a collection of short stories, poetry, and a dramatic work or play). The prescribed text list from which this choice must be made includes film and play scripts, Shakespearean drama, contemporary literature, literature in translation, historical texts, and texts with Australian content or authorship. Thus *all* students taking English Literature in Western Australia will study poetry and drama. The dramatic work may or may not be a Shakespearean play.

Looking at one text type:

Texts of the media or multimedia type are mandated for Standard English and Advanced English in New South Wales and for English Communication in Tasmania. The prescribed text list for English in Victoria includes texts that are of the media or multimedia type.

Table 4E: Skills made explicit in TER English courses

Skill/ focus/objective	No. of jurisdictions (out of 7sets of documents)	Nature of English option in the jurisdiction
Making meaning through texts	7	Highest enrolment TER
Understanding the role of context in text construction and interpretation	7	Highest enrolment TER
Critical thinking	7	Highest enrolment TER
Participating in society; social cohesion	7	Highest enrolment TER
Effective communication skills	6	Highest enrolment TER
Using correct spelling, punctuation and grammar	7	Highest enrolment TER
Self-understanding; developing personal identity	7	Highest enrolment TER
Understanding values, ideas, attitudes, beliefs; past, present and change	7	Highest enrolment TER
Understanding cultural diversity	6	Includes one TER English Literature subject
Learning capacity	5	Includes one TER English Studies subject
Understanding the power of language	6	Highest enrolment TER
Understanding and using a language framework/system	3	Includes one TER English Literature subject
Enjoyment of language/literature; personal enrichment	5	Highest enrolment TER

Note: The information refers to the TER English courses/options with the highest enrolment in each jurisdiction unless otherwise noted (and counting the Northern Territory and South Australia as one for the purposes of this table). A specific subject option is named in the third column where it is the case that more than one TER English course is offered in that jurisdiction and it is the second course that specifies the skill described, although this does not necessarily mean that it is absent from other English courses.

Commonality in English

The estimated degree of consistency in Year 12 English across the country is as follows:

Text types covered = 25%+

Required specific texts = 0%

Skills/objectives covered = 30%+

There are differences in the range of English subjects available in the different states/territories, subsequently offered at the school level, and finally selected by students (or in some cases, mandated by the system).

Where students do a more 'practical', communication-intensive subject, less attention is given to Literature and greater attention is given to function and application, non-fiction, analysis and production of shorter texts for a variety of purposes, including spoken communication.

Where students do English 'Literature' or English 'Studies', there is typically more attention given to extended texts, fiction as well as non-fiction, and responses (in multiple media) to texts. Any kind of more 'advanced' English course is likely to place more emphasis on study and/or production of creative texts.

Where there is a single main English subject, there is generally more evenly distributed attention given to the demands of communication and the study of extended texts. The specific texts that student study vary dramatically, because quite lengthy text lists are prepared, selected by panels operating with a degree of subjectivity, and selected from and/or extended further by teachers within individual schools.

Certain features are ubiquitous, prominent amongst these being 'meaning' (encompassing understanding ideas and values), critical thinking, the context and function of texts, development of self, and the use of language conventions. Within and beyond these, there is much room for choice of emphasis, depending again on individual teachers and the nature (interests and perceived needs) of their students.

Overall, there is evidence that English is perceived differently in certain ways in some jurisdictions, and those ways mainly encompass the different descriptions of language itself.

There are two ways of viewing the results of this study of English curricula, both equally valid. One view holds that there is no evidence that students in any part of Australia are studying the same thing while at the same time there is nothing to prove that students in any part of Australia are not studying the same thing. That thing could be anything from Shakespeare to semiotics. The other view holds that all English curricula/syllabuses across the country allow considerable flexibility. Because teachers can select the texts and teaching methods that they consider appropriate for their own students, there is little restriction on what may be represented in the classroom.

Summary of degree of consistency in nominated subjects

Two sets of bar-graphs follow. They summarise estimated degrees of curriculum consistency in the five subjects being investigated.

The set of graphs for subject matter includes one graph each for Australian History, Chemistry, and Physics topics, one for English text types, and two graphs for Mathematics topics, one for highest-level mathematics and one for subjects of the social mathematics variety.

The set of graphs for skills includes one graph each for Australian History and English. These subjects were chosen because of issues discussed earlier in this chapter about identifying content in terms of topics to be studied.

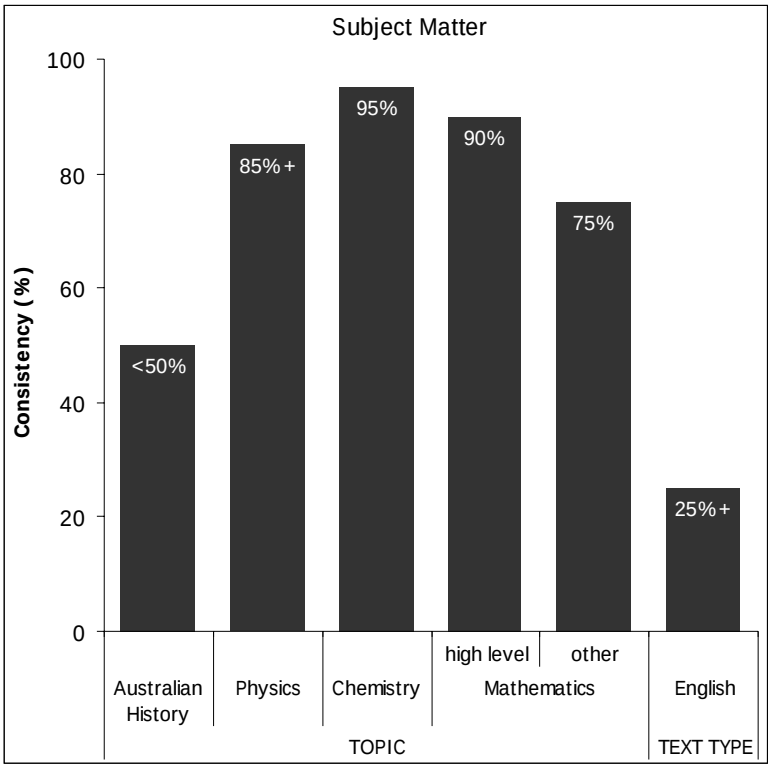


Figure G1: Estimated degree of curriculum consistency in subject matter, five subjects

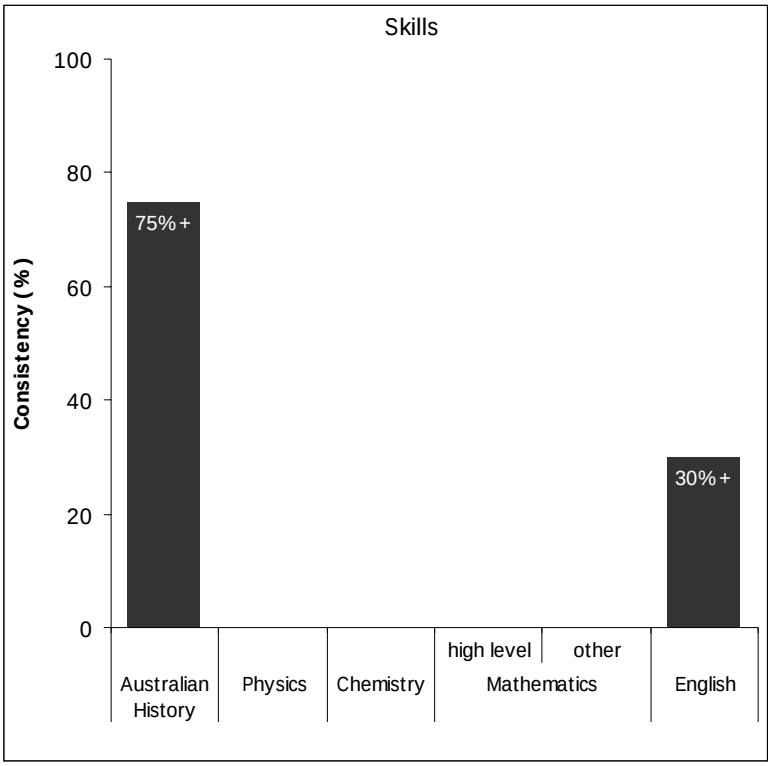


Figure G2: Estimated degree of curriculum consistency in skills, two subjects

General observations after the mapping exercise

At every point and at every level in the documentation that has been studied, it was found that there is at once a high degree of consistency and a high level of variability. For example, in spite of the occasionally high level of variability in language used across jurisdictions, there appears to be a high degree of consistency in requirements for topics to be studied and skills to be developed in all of the subjects with the exception of English. The phenomenon of pervasive themes with unpredictable variations on those themes (such as in the way electives are used) is expanded upon during this report.

Highly generalised language is often used in curriculum documents. The effect is sometimes to avoid stating the specificity and distinctiveness of a domain of learning (or subject) in favour of a language that could apply equally to several (or all) domains. For example, some definitions of, and rationales for, mathematics have almost nothing in the definitions or rationales to suggest mathematics apart from the use of the name.

Often, it is not possible to be certain about the existence of commonality. That is, differences in approaches to defining the curriculum might actually signal differences in practice or it might be the case that the apparently different prescriptions of content actually converge into common learnings across the country. At the level of prescription (the 'intended' curriculum) and taking language used to describe curricula at face value, it is more probable than not that there are differences in what is studied (the 'experienced' curriculum).

The way language is used in curriculum documents across jurisdictions might suggest false commonalities. For example, the phrase 'text + context' is often used in English curriculum documents but it is uncertain as to which texts are constructed and deconstructed and in which context. For example, in some English courses there are set texts, in others there are set categories of text, and in others there is open choice. The set categories of text might be chosen from a set list, or might possess some specificity, or might be in the form of a recommended list rather than a mandated list. After all these options and electives, it is quite within the bounds of probability/possibility that every Australian student of senior English is exposed to at least one common mainstream novel.

When one conjures up an image of an unidentified student sitting in a Year 12 classroom somewhere in Australia studying an English subject that counts toward a TER, one would not easily identify the state/territory by what is happening in the classroom and certainly not by the texts that are being studied even though the syllabus documents give the impression that it would be otherwise. It is only when the students are chatting at morning tea-time that their location could be revealed (assuming that their conversations were about school)—as they spoke about the ritual of their assessment. For example: Does this assignment 'count' towards the exit level of achievement? (This could be a student from Queensland or the ACT.) Have you seen the exam timetable yet? (This could be a student from New South Wales.) It is highly unlikely that the distinguishing feature of a conversation in one state/territory would be Dylan Thomas and in the other state/territory Patrick White.

Returning to the documentation—the way language is used across jurisdictions might hide real commonalities. For example, 'spelling, sentence structure and punctuation' is used in some places whereas 'linguistic structure and features' is used in another.

In summary, there is an infinite number of ways of satisfying curriculum objectives for a subject called English. For Australian History there is a commonly held view of the nature of the subject (historical inquiry). Physics and Chemistry, being well-established domains with clear conceptual frameworks, appear to have a high degree of consistency. For mathematics, where the situation is complicated by the diversity of subject offerings, there is a high degree of consistency over the totality of offerings across jurisdictions.

We realise of course that, when the curriculum documents that form the basis of this study were written by curriculum and assessment agencies around the country, they were not written with the

intention of serving a comparative study such as this one. They were written to serve their own education systems and, to a lesser extent, their various publics. And this, no doubt, will be one of the counter-arguments from the ACACA agencies when we report on differences identified by using those documents as our source of information. Comparative information from other sources, where the boundaries are by subject rather than by jurisdiction, has increased the robustness of the information obtained from official curriculum documentation.

University personnel and curriculum development

Specific Objective No. 2 required the identification and description of the nature and extent of the involvement of university discipline specialists in the development of content, curriculum and assessment criteria. The ACACA agencies were approached in pursuit of relevant information. A written request was made:

> …Part of the data of interest are the structures in place for writing or reviewing curricula. We have not been able to find subject-specific details, so we are asking for your help in answering the following enquiries for each of the subject areas English, Australian History, Chemistry, Physics and Mathematics.
>
> For the committee responsible for each subject's curriculum/syllabus development:
>
> - Title of the committee.
> - Nature of the committee (eg, standing committee meets four times a year/ad hoc committee appointed as required).
> - Position of the committee (eg, reports to Standing Committee on Curriculum/reports direct to the authority).
> - Structure of the committee (eg, two teachers, two tertiary representatives, one member of the authority as Chair).
> - Membership of the committee (names and titles of members for current, or most recent, committee).
> - Outline of committee's role (eg, research new developments in curriculum/write a new curriculum/review particular parts of curriculum).
> - Relationship of committee to curriculum writers (eg, writers are a subgroup of the committee/writers appointed by committee/writers appointed by authority, committee has oversight of their work).
> - Role, if any, of discipline specialists either on the committee or as external consultants.

Admittedly this set of questions carries with it a set of assumptions about course development and accreditation that matches the traditional model in Australia for governance and curriculum structures at senior secondary level. It was based on one jurisdiction's model for syllabus development, which happened to be readily accessible (QSA).

Some agencies were able to respond before the MCEETYA directive for non-collaboration with ACER on this project. The Tasmanian Qualifications Authority (TQA) has recently approved a set of guidelines for course accreditation, to be applied to courses developed by TQA and to courses developed by other agencies for which TQA accreditation is sought. The guidelines are comparable with those for VET course accreditation, where courses other than training packages are developed by the course owner and not by the accrediting authority.

The CEO of TQA stated that 'the substantive elements, but not the processes, present in your list of questions are evident in these guidelines and in our practice in the development and accreditation' of Student-directed Inquiry and Manufacturing Studies for which TQA has approved a set of guidelines for course accreditation: development with input and oversight from a range of stakeholders and experts including industry, academic, teaching; and commissioned reviews/advice/writing from external experts, including discipline experts and assessment experts.

Information about syllabus/curriculum development in History subjects, although not validated by the ACACA agencies, is presented in Table 5H.

Table 5H: Involvement of university discipline specialists in History curriculum development, all jurisdictions

Australian History[a]	ACT	QLD	NSW	SA/NT	TAS	VIC	WA
The syllabus committee reports to the assessment/examination authority.	√	√	√	√	√	√	√
The committee is specific to the subject (eg, History) rather than curriculum area (eg, SOSE).	√	– [b]	√	√	√	√	√
At least one university discipline representative on the committee is specified.	– [c]	√	√	– [d]	– [e]	√	√ [f]

a. Refer to Table 1H for the interpretation of Australian History used in this report.

b. Social and Environmental Studies Syllabus Advisory Committee

c. All members of the History Course Development committee are attached to schools.

d. Occupations of the History Subject Advisory Subject Committee are not given. They do not appear to be academics.

e. Members of the consultative groups are not listed in the handbook or other documentation.

f. Post-secondary education

Information about Mathematics syllabus/curriculum development in three other jurisdictions (ACT, New South Wales and South Australia) using a committee structure was gleaned from easily accessible public documents. All include representatives of the higher education sector. University discipline specialists have 'oversight as committee members' in New South Wales.

Overall it is the case that the 'learned community' forms part of the decision-making process in curriculum development. Reportedly these members are influential in the development of content, curriculum, and assessment criteria (and especially content). The nature of their influence is of course of function of their own ideology and philosophy of education.

Conclusion

The degree of curriculum consistency varies from subject to subject across Australia.

Physics and Chemistry are subjects with a very high degree of national curriculum consistency. Each state and territory offers subjects called Physics and Chemistry, and an analysis of the curriculum in these subjects shows that at least 85 per cent of curriculum content—both subject matter and intended skills/understandings—is common to all eight jurisdictions.

In Mathematics, 27 different TER courses are offered across Australia. These courses are designed for different purposes and for students with different abilities and interests. Within these 27 courses, each state and territory offers a course that is identifiable as high-level mathematics. An analysis of these high-level mathematics curricula reveals a high degree of consistency across the eight jurisdictions. Approximately 90 per cent of the content of these high-level courses is common across states and territories.

Among more than twenty TER History courses on offer across Australia, only two are called 'Australian History'. Eleven of the twenty courses contain some Australian history, and there are three courses in Aboriginal studies that also contain some Australian history. In these fourteen courses, the subject matter (topics) of Australian history is generally embedded in a thematic or contextual approach. This means that it is not possible to identify specific topics (eg, particular historical periods) that all students are required to study across the country. Nevertheless, there is a moderate degree of

consistency in the topics (eg, Federation) that teachers can choose as contexts for the in-depth study of issues. Also, there is general agreement in all curriculum documents on the purposes of studying History at senior level, on the skills of historical inquiry that students are expected to develop, and on the approach to the study of History.

There are eighteen TER English courses on offer across Australia, not including courses in English as a Second Language (ESL). Four of these courses contain the word 'Literature' in their title. Commonality across states and territories can be found in the study of 'text types'. State and territory curriculum documents mention a total of fourteen different text types (eg, Poetry), and most jurisdictions require students to study some particular types of text. The study of novels and plays is required in all jurisdictions except Queensland, which suggests a balance across text types, but does not require the study of any one particular type.

Text types also provide a way of identifying where literature is contained in senior English curricula apart from designated 'Literature' courses. For example, in Victoria, the English course requires that students study at least four texts from a selection of 13 types that include Poetry, Literature in Translation, Shakespearean Drama and Contemporary Literature. There is a high degree of agreement in state and territory documents on the skills and understandings that senior English courses are intended to develop. These range from 'using correct spelling, punctuation and grammar' to 'making meaning through texts'.

What students are required to study in English in the states and territories is not expressed in terms of topics. In some English courses there are set texts, in others there are set categories of text, and in others there is open choice. There are no specific texts that all Australian students are required to study.

Chapter 3 – Curriculum content: What is essential?

Critical question

One of the critical questions in this study is about the notion that, for each subject, there are essential topics, skills or 'big ideas'. The question is sometimes framed in a simple way: What should all young Australians know[22]? In a more operational form, this question can be framed as: What should all students know after studying a particular subject to the end of Year 12? These questions are probably what the public means when the idea of essential knowledge is discussed.

The central purpose of this study is not to ask the open question: What should be in the senior curriculum for English (including Literature), Mathematics, Physics, Chemistry, and Australian History? It is to ask a more structured question: Does what is currently in the curriculum, as revealed by the mapping exercise (described in Chapter 2), reflect (or not) what reviewers consider to be essential?

Essentialness

We have made up the term *essentialness* to refer to the status of content areas within subjects as measured by the extent to which a sample of the community considers that these content areas (subject matter and skills) should be mandatory learnings. Measures of essentialness can then be compared with measures of commonality, defined earlier as the degree to which students across the country are currently exposed to that content area.

In this chapter we discuss the results of an analysis of what amongst the content of current offerings (in the five subjects under investigation) is considered to be essential. Asking this question of a sample of academics, teachers, teacher educators and professionals from occupations outside education is not unlike thinking about the classic statement from quantum chemistry: 'The *d* electrons are equivalent but some are more equivalent than others'. Subject specialists whether in the education field or the general community tend not to view any aspect of their subject area as unnecessary for study. This study proceeded on the assumption that reviewers would decide that some topics are 'more equivalent than others'; that is, more deserving of the label 'essential' for the inclusion in the senior curriculum.

This notion of essentialness is not as simple as it may appear. At one level it seeks a kind of universal value: These are the topics that define Physics (or History or Chemistry) and without them the student is not learning the subject (or, in the words of one respondent to the review questions presented later in this chapter, 'Not History without this!'). If this were true, one would assume that virtually any

[22] 'Know' includes know, understand and be able to do. Knowledge can include facts, concepts and procedures.

respondent would make the same judgment about those topics. In fact, in most areas, there are significant variations about some of the topics nominated as essential by some reviewers.

In the case of Australian History, for example, some topics that might generally be regarded as unproblematically essential were not ranked as essential by all respondents. These included, for example, Federation and World War 1. Indeed there is virtually no topic in History that all respondents regarded as essential *content* although there is nationwide agreement on what constitutes 'historicity' (the skills of historical inquiry).

In Physics, while there is a wider agreement about knowledge, and a number of topics that are almost universally supported (eg, Newtonian mechanics, Measurement, Wave motion. and Electromagnetism) or not supported (Astronomy/astrophysics, Special relativity) there are still disagreements about some matters which seem equivalently valuable (eg, Thermodynamics).

The project has, however, had to deal with somewhat more complex ideas about what is essential. In addition to the apparently relatively simple judgments implied so far, the kinds of factors that seem to lie behind judgments in the education sector find expression in questions such as:

- What is possible to teach in a normal Year 12 classroom?
- How can a subject be best taught?
- What do respondents feel has been important to them?
- What are the political or values implications of including or not including a topic?

What is possible to teach in a normal Year 12 classroom? In the case of Australian History, for example, a number of respondents felt that, while the history of the developments that led to Federation might be important, it was difficult to teach because it was not engaging or attractive to students. The idea of 'essentialness' for these respondents is broader than a simple measure of significance. It includes a judgment about the feasibility of making that topic interesting. It also seems to incorporate tactical views about the effect of including a topic: If pre-Federation is important, it will have to be taught relatively early in the course, so it risks losing students before they get to the more engaging topics. In some cases, the judgment relates to a sense of the 'degree of difficulty' of the topics; some respondents argued that 'Interpreting history' was essential, but one indicated that it was too difficult for some students because it 'encompasses an understanding of historiography'. A similar view seems to be taken about special relativity in Physics because, while the topic is regarded as interesting and explanatory, some saw it as too difficult, or more suitable for students 'with the interest and aptitude for it'.

How can a subject be best taught? In Physics, a number of respondents argued that Electronics was not essential in the same way as some other topics, but that it could be viewed as more important because it offered a link with students and their lives that enabled the teaching of some other topics, or that made the subject seem more attractive than it would otherwise be. In Australian History, most respondents felt that a study of significant Australians or a 'local hero' was not inherently an essential topic but, in the words of one respondent, 'the biographical approach might be a useful means of teaching history'.

What do respondents feel has been important to them? In some subjects (of which History is the most obvious), some respondents proposed additional topics as essential which seemed difficult to justify on an objective scale of importance, but which seemed to resonate with their values and priorities. In Australian History, these included the Vietnam War (or in one case 'Vietnam war and protest'). It is difficult to argue that Vietnam has the same general historical significance as the two World Wars, or as a number of other significant topics (Federation, immigration). Some individuals, however, in their judgments about what is essential seemed to incorporate a category related to significance to contemporary life, rather than a broader judgment about longer-term historical significance.

What are the political or values implications of including or not including a topic? Some areas provided sharp dividers around values issues. The study of 'Aboriginal culture/perspectives' in Australian History polarised respondents. Responses varied from strong support, with an emphasis on values of social justice and a focus on the relationship to land, oppression and resistance, to moderate support, with a view that the emphasis should be on stories and narrative, to a relatively negative view, with a comment that sources in the area are unreliable. In Physics, some argued that the application of Physics to real-life problems was essential, because of its relationship to making 'informed decisions in the future' or to help students see 'the big picture'.

Survey of reviewers

A number of reviewers were invited to make independent judgments about the curriculum content for each subject. Members of DEST's project Advisory Group nominated suitable persons as reviewers.

To ensure a variety of perspectives, reviewers were sought from four categories.

The academic perspective was provided by university discipline experts who teach the subject to first-year university students (excluding education students); the professional perspective was provided by people working in a field/industry/profession that is underpinned by knowledge and skills related to the subject; the teacher-educator perspective was provided by people who teach the subject to student teachers who will in turn teach the subject in schools at the senior level; and the practitioner perspective was provided by people who currently teach the subject to Year 12 students.

Multiple perspectives are important because it was anticipated that the people providing perspectives would not necessarily share the same view. Having multiple perspectives was also seen to preclude the necessity to acknowledge and balance existing polarities of opinion, which are well known in subjects English and History particularly.

The academic perspective was to emphasise epistemology and rigour; the professional perspective the career marker and connections to the wider world; the teacher-educator perspective the alignment of curriculum, pedagogy and assessment; and the practitioner perspective was to emphasise pedagogy and equity. Delineating perspectives in this way is not to imply that these notions are unique to particular perspectives or that there is always a direct relationship between pairs of notions (eg, between epistemology and rigour). The reason for the different emphases was to contain the territory that would have to be traversed by reviewers from different backgrounds.

Each reviewer was provided with two tasks. Both tasks required that reviewers fill in a table.

For the first task, the topics listed in the table were those that had been identified as common to at least two jurisdictions in the mapping exercise. The number of topics is different from subject to subject (hence the variable *n* in the prototype table below). The reviewers were given no indication of the frequency with which each topic had been shown to occur across the eight jurisdictions through the mapping exercise (eg, whether it occurred in only two jurisdictions or in all jurisdictions). The table included a blank space so that reviewers could add other topics that they considered to be essential but that not been identified in the mapping exercise as being common to at least two jurisdictions.

Reviewers rated each of the topics listed, the four available response categories being:

Essential All[23] students taking this subject[24] definitely should be exposed to this topic.

Desirable It is desirable but not essential that all students taking this subject are exposed to this topic.

[23] It is assumed that the rationale for the subject will indicate the group of students for whom the subject is designed. If this is the case then we can refer to **all** students taking the subject.
[24] Or any subject of which this subject is a component

Possible It is unimportant to me whether or not students are exposed to this topic.

Not desirable It is inappropriate and/or undesirable at this level (senior secondary school).

Reviewers were also required to give reasons in the 'Comments' column if (a) they added an extra topic or (b) the rated a topic to be 'not desirable'. In any subsequent discussions about core curriculum, arguments for eliminating topics might be important because experience has shown that teachers, understandably, consider all aspects of their subject worthy of inclusion.

Prototype table: Topic ratings for subject S

Content	Rating				
Topic	Essential	Desirable	Possible	Not desirable	Comment
1.					
2.					
3.					
4.					
5.					
6.					
7.					
n.					
Other: ……					

It was intended that the label 'desirable' would be assigned to topics considered to be worthwhile or that at least some students should be exposed to it, but that fell short of being something all students taking the subject should do.

It was intended that the label 'possible' would be assigned to topics where, although the reviewer could see that there might be an argument for having the topic mandated, s/he was not persuaded by it. It is also conceivable that a reviewer would be ambivalent about the inclusion of that topic.

'Not desirable' was not meant to have the connotation of 'objectionable' that often accompanies 'undesirable'. It was intended that the label 'not desirable' would be assigned to topics considered to be unnecessary for whatever reason—it might be considered too advanced or too trivial for Year 12 study, or unnecessary in a crowded curriculum, or hackneyed or lacking currency and so on.

In the second task, the skills listed in the table were those that had been identified in the mapping exercise as being explicit in curriculum documents in at least two jurisdictions. The number of skills is different from subject to subject. Again, the reviewers were given no indication of which jurisdictions' curriculum documents had been identified in the mapping exercise as mentioning each of the skills (eg, whether a particular skill occurred in New South Wales and Queensland or in the curriculum documents of all eight states/territories). As for the first task, the table in the second task included a blank space so that reviewers could add other skills that they considered to be essential but that not been identified in the mapping exercise as being common to at least two jurisdictions.

No prototype table is provided here because the *Skill rating* table is similar to the *Topic rating* table.

Results of the reviewing exercise

The following explanatory notes apply to analyses of each of the five subjects, which are discussed in turn.

Subject content

For each subject (S), Figure 1S shows *commonality* across the country of topics identified in the mapping exercise. Topics were assigned to one of three categories based on evidence from the mapping exercise.

- Topic (content area) offered in at least two jurisdictions (2 or 3)
- Topic (content area) offered in several jurisdictions (4 of the 8)
- Topic (content area) offered in all or nearly all jurisdictions (7 or 8).

For each subject (S), Figure 2S shows the combined ratings about *essentialness* given by external reviewers. Essentialness is about the degree to which each of the topics from Figure 1S is considered to be essential for students taking that subject for the Year 12 certificate. The available response categories are described in the previous section.

We summarised the reviewers' ratings for each theme, topic or text type as the proportion of reviewers rating it as 'essential', 'desirable', 'possible', and 'not desirable', ranked by 'essential' proportion. The approach not only shows how essential the content area was seen (as voted by the reviewers) but also shows the spread of reviewer opinion (eg, for a content area, were the reviewers polarised at 'essential' and 'not desirable'?). We inferred that a content area is more essential when a higher proportion of reviewers rated it as essential.

Figures 1S and 2S are presented side by side so that visual comparisons can be made between commonality and essentialness.

Figure 3S is a graph that captures the *relationship between mapped commonality and judged essentialness* for each of the *topics* found to be common to at least two jurisdictions.

Figures 4S and 5S provide *information about the reviewers and their judgments*. Figure 4S gives the frequency distribution for reviewers' ratings by category (four degrees of essentialness). Figure 5S gives the frequency of topic ratings assigned by each of the reviewers.

Figure 6S, 7S and 8S are graphs about skills that parallel figures 1S, 2S and 3S for topics. For example, Figure 8S is a graph that captures the relationship *between mapped commonality and judged essentialness* of each of the *skills/values* found to be common to at least two jurisdictions.

Figures 9S and 10S are graphs about reviewers and their judgments that parallel figures 4S and 5S. For example, Figure 9S is a graph that gives the frequency distribution for reviewers' ratings by category (essential, desirable etc.).

The five subjects under investigation are discussed in the following order.

1. Australian History
2. Chemistry
3. English (including Literature)
4. Mathematics
5. Physics.

Comments from reviewers for English and Mathematics appear as Appendix 1.

An aid to reading the figures

Readers might elect to skim this explanatory section and return to it only as required in interpreting the large volume of graphs that follow it.

Figures 1 and 2 in each set, as illustrated by Australian History:

There are 24 horizontal bars in Figure 1H. There is a gap between the first 16 bars are the last 8 bars. These bars correspond to the 16 themes and 8 topics in Table 3H (Chapter 2), which are present in the curricula of at least two jurisdictions. The bars are of one, two or three units in length depending on whether the number of jurisdictions was 2–3, 4–6, or 7–8. For example, the topic, Waves of immigration, is common to 7–8 jurisdictions (it had three stars in Chapter 2).

The bars in Figure 2H are for the same 16 common themes and 8 common topics. The bars are arranged vertically in decreasing order of magnitude of essentialness. Again there is a gap between themes and topics. The total horizontal length of all bars represents 100 per cent of reviewers' opinions, divided up according to the percentage of total reviewers who rated the topic 'essential' (the black section of the bar), 'desirable' (the dark grey section of the bar), 'possible' (the light grey section of the bar), and 'not desirable' (the light hatched section of the bar). For example, the topic, Significant Australians, was considered to be essential by approximately 12 per cent of reviewers, desirable by 14 per cent, possible by 59 per cent, and not desirable by 15 per cent.

Figures 1H and 2H are presented alongside each other so that commonality and essentialness can be easily compared. For example, from Figure 2H it can be seen that reviewers considered the theme, nature and impact of immigration (top bar), to be the most essential of all the themes. From Figure 1H it can be seen that nature and impact of immigration is in the curricula of some jurisdictions but not all.

Figure 3 in each set plots commonality (from Figure 1H) against essentialness (from Figure 2H). It tells us the extent to which subject matter considered most essential by reviewers is actually present in existing curricula. The further a diamond is to the right the more essential it is deemed to be. The higher a diamond is on the page the more common it is. There is not a strong relationship between essentialness and commonality for Australian History. Compare this with Figure 8E (Relationship between commonality and essentialness for English skills). There is a cluster of skills deemed to be most essential by reviewers. All of these skills are found in all or nearly all jurisdictions' curricula. The one skill considered to be at most just a possibility, Using a language framework or system, is not found in more than a couple of existing curricula.

A similar explanation applies to **Figures 6, 7, and 8**, which are about commonality and essentialness of *skills* (except for Mathematics where skills were not analysed).

Figures 4 and 5 in each set refer to the response categories chosen by reviewers when asked to rate essentialness of topics/themes. The Australian History graphs are again used as examples. In Figure 4H, the height of the bar for 'possible' is approximately three times the height of the bar for 'not desirable'. The total number of ratings assigned by reviewers to any topic or theme was in the ratio 3:1.

Figure 5H shows that reviewers A and B gave more 'essential' ratings than did other reviewers while reviewer K gave the fewest 'essential' ratings. The overall percentage of 'essential' ratings was 46, as indicated by the label on the bar to the far right of the figure.

The 'Conclusions' section at the end of this chapter includes significant examples from within and across the five subjects being examined in this study.

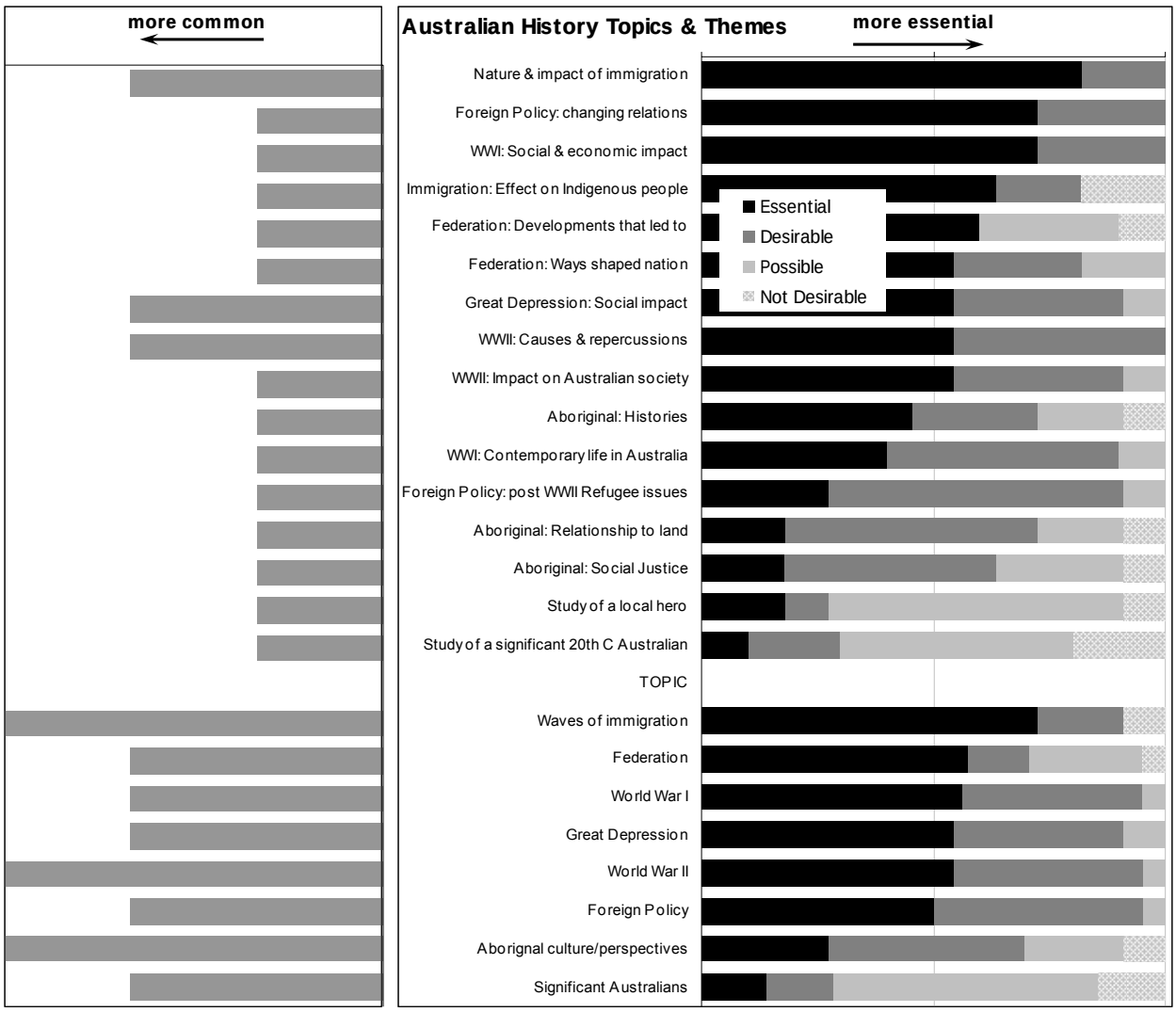


Figure 1H: Commonality of Australian History topics from mapping

Figure 2H: Essentialness of Australian History topics from reviewing

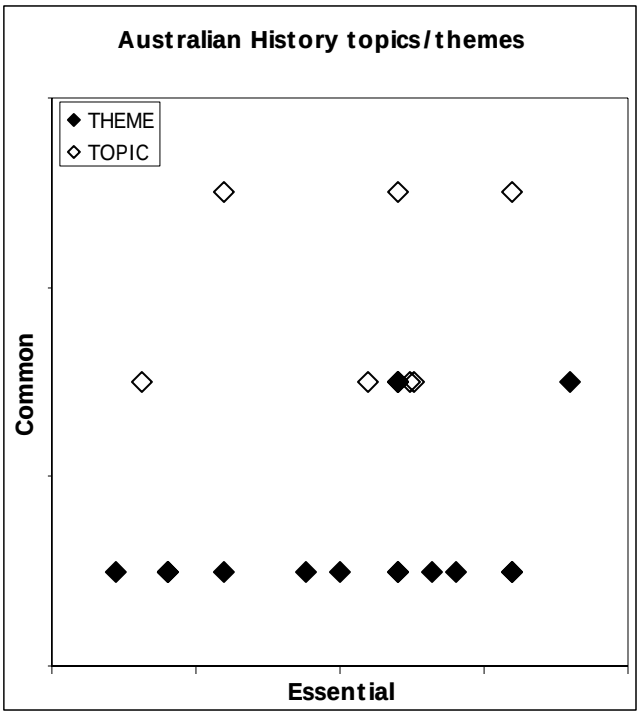


Figure 3H: Relationship between commonality and essentialness for Australian History topics

Note: The ratings for topics, as distinct from themes, are an average of the rating for the themes that comprise that topic. About half the reviewers gave a rating for the topic (as a heading) as well as for the constituent themes. In the scatterplot, topics are shown with open diamonds, themes with closed diamonds.

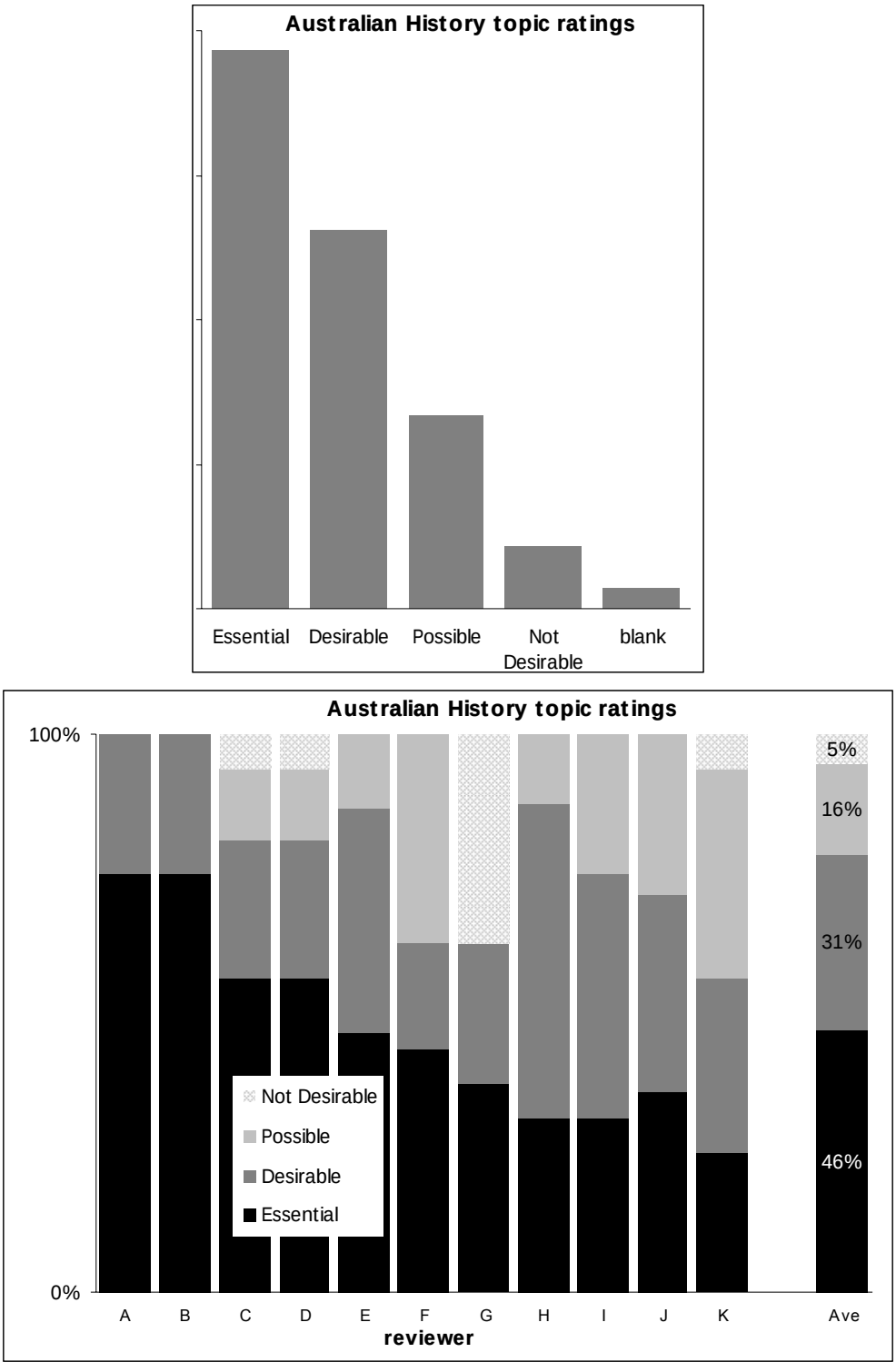


Figure 4H: Frequency of topic ratings given overall for Australian History

Figure 5H: Distribution of topic ratings given by each Australian History reviewer

Note: The 'blank' category in Figure 4H refers to omitted responses.

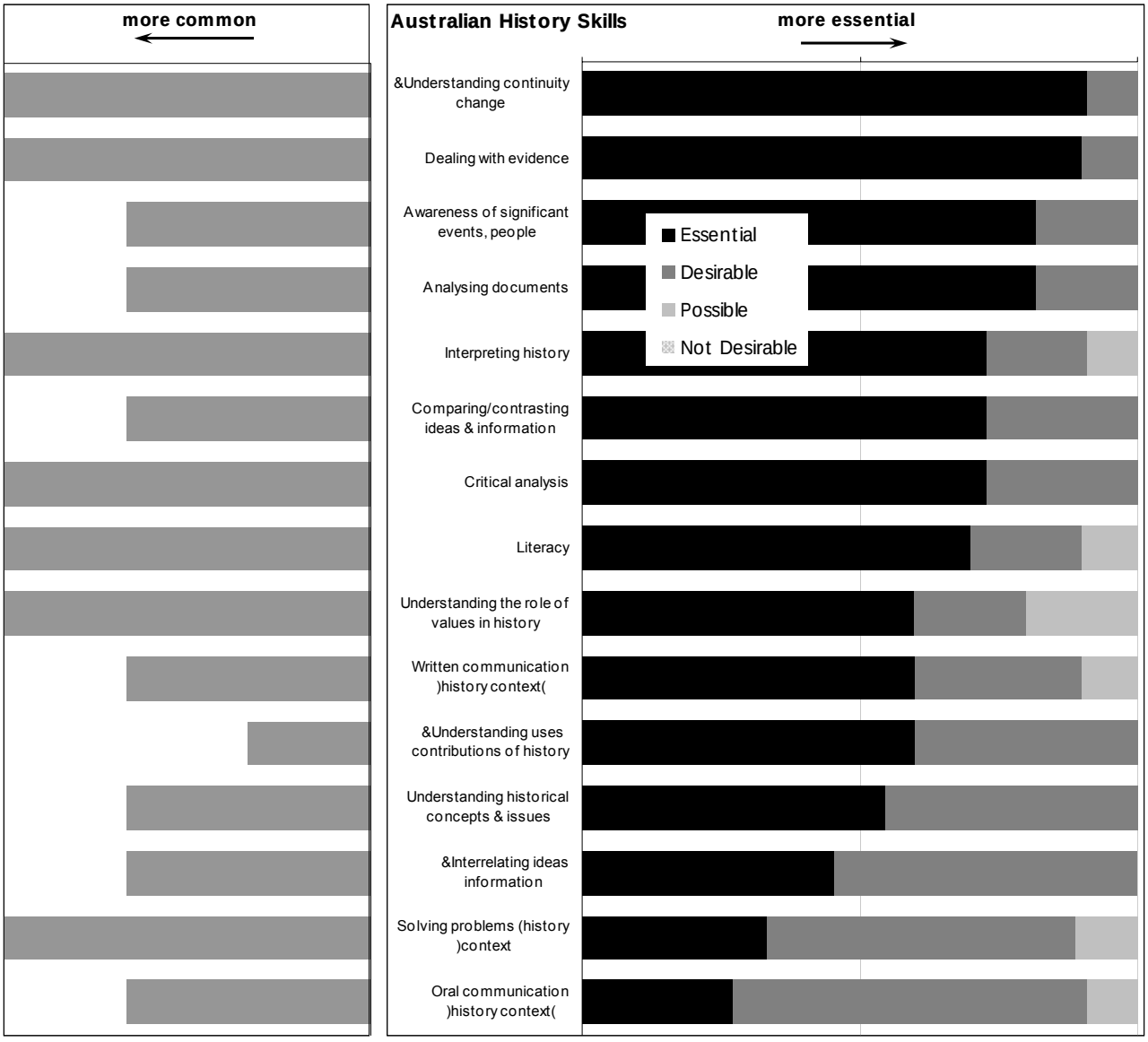


Figure 6H: Commonality of Australian History skills from mapping

Figure 7H: Essentialness of Australian History skills from reviewing

Note: There were no 'Not desirable' ratings for the skills.

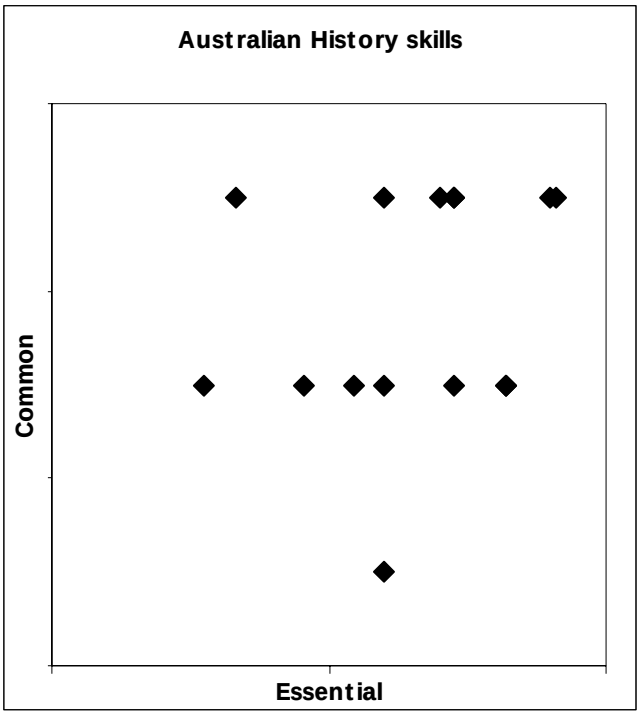
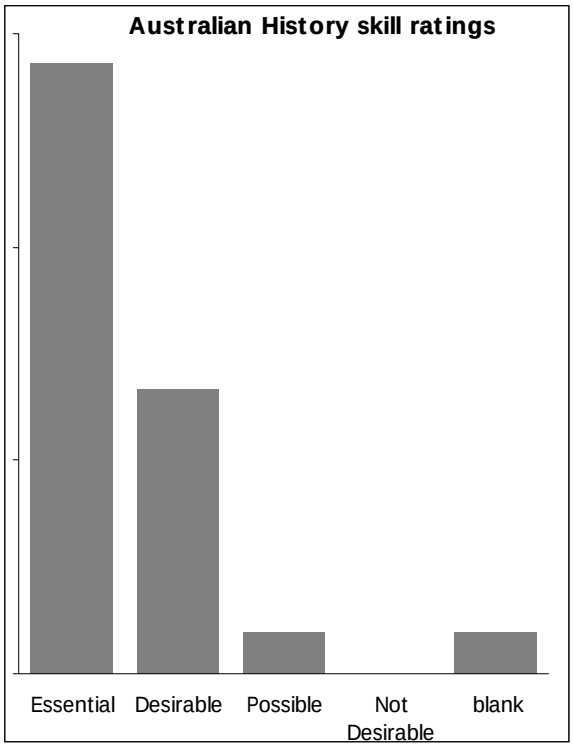


Figure 8H: Relationship between commonality and essentialness for Australian History skills



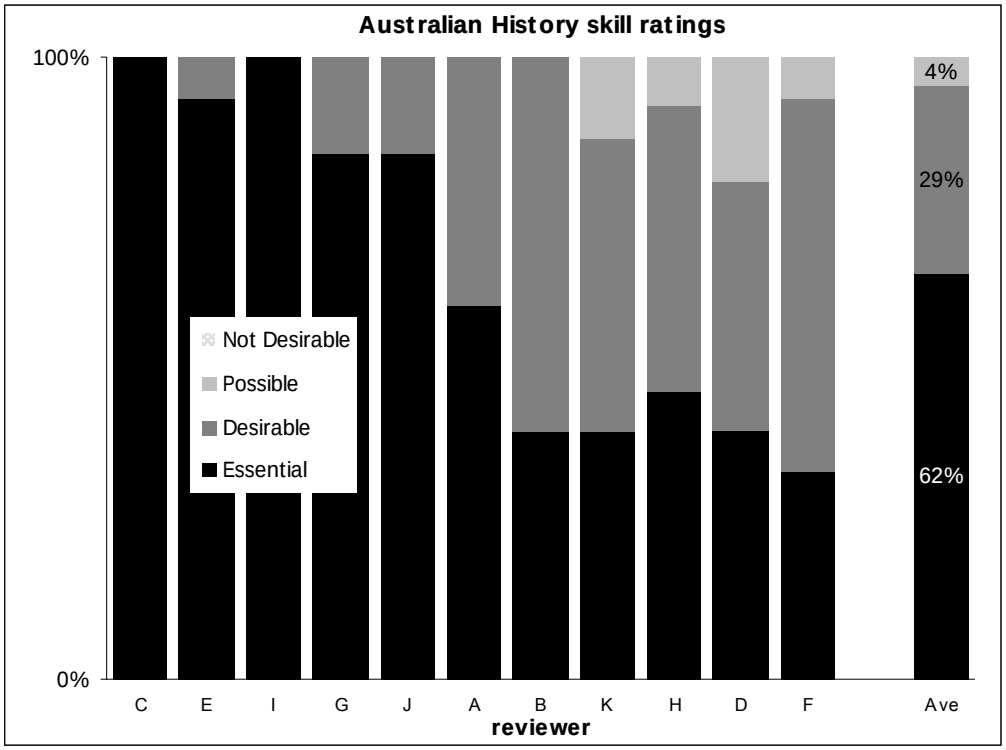


Figure 9H: Frequency of skill ratings given overall for Australian History

Figure 10H: Distribution of skill ratings given by each Australian History reviewer

Note 1: Reviewer ID is the same as for topic, which is why they are not in alphabetical order here.

Note 2: The 'blank' category in Figure 10H refers to omitted responses.

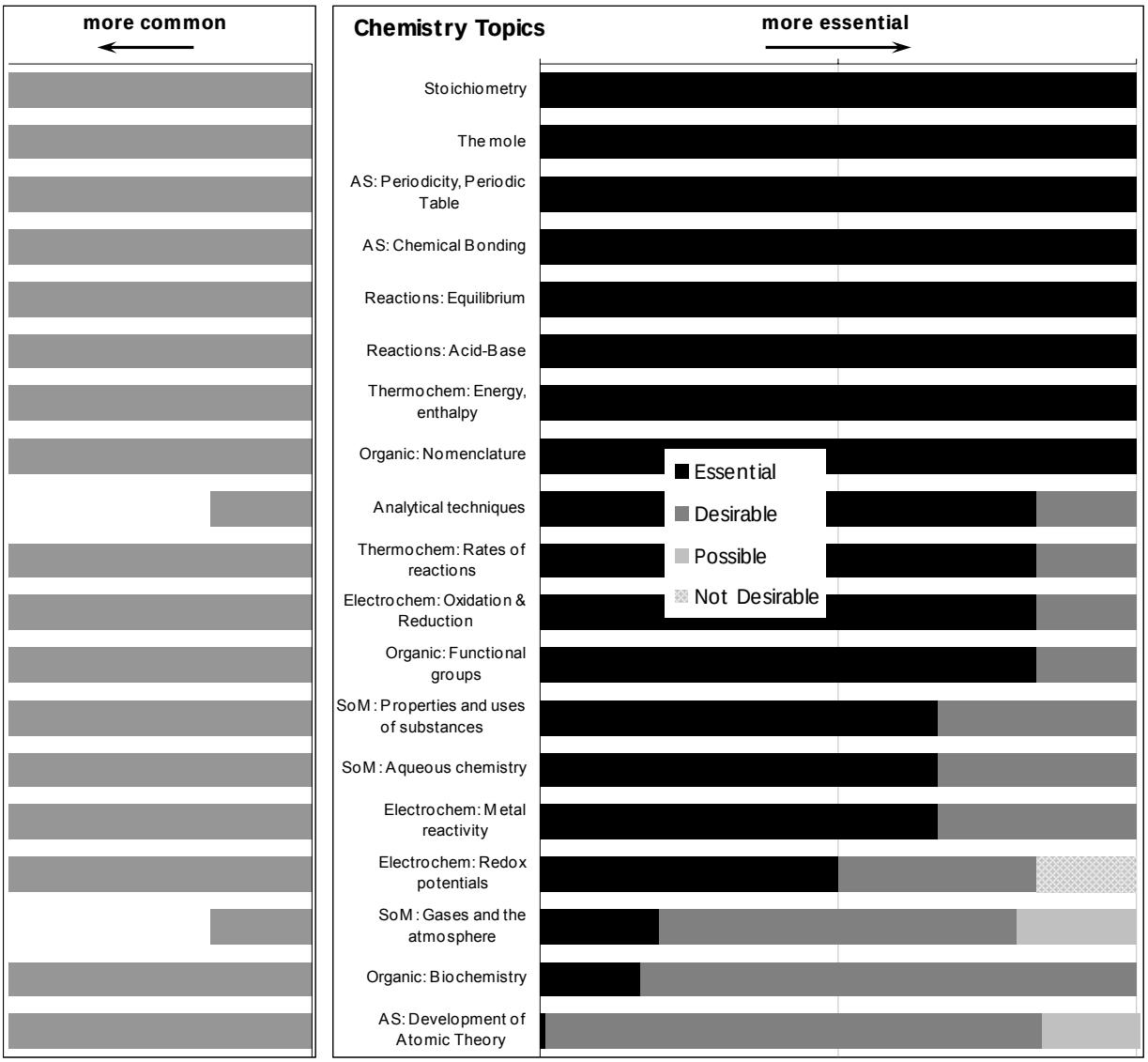


Figure 1C: Commonality of Chemistry topics from mapping

Figure 2C: Essentialness of Chemistry topics from reviewing

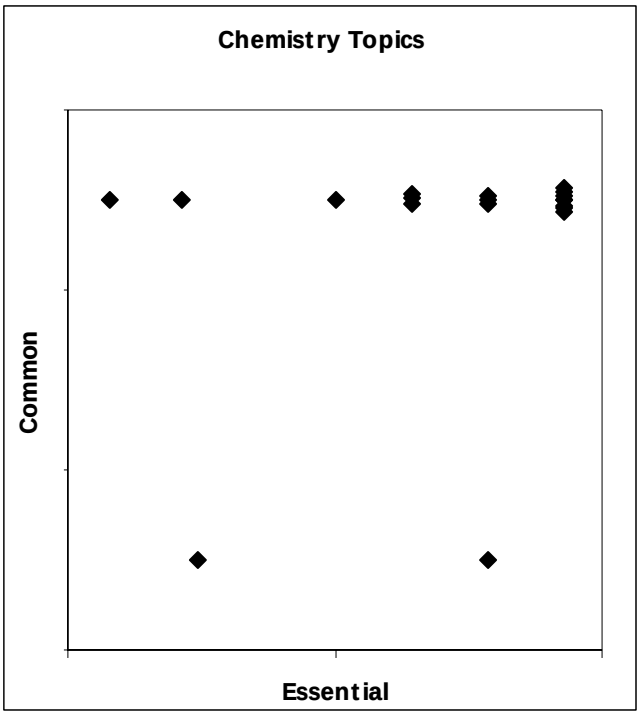
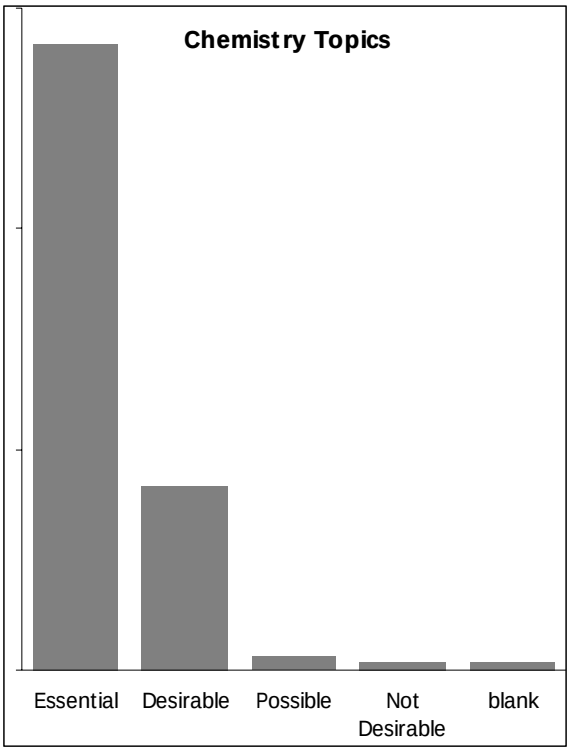


Figure 3C: Relationship between commonality and essentialness for Chemistry topics

Note: A random 'jitter' is applied to points in the scatterplot that overlap.



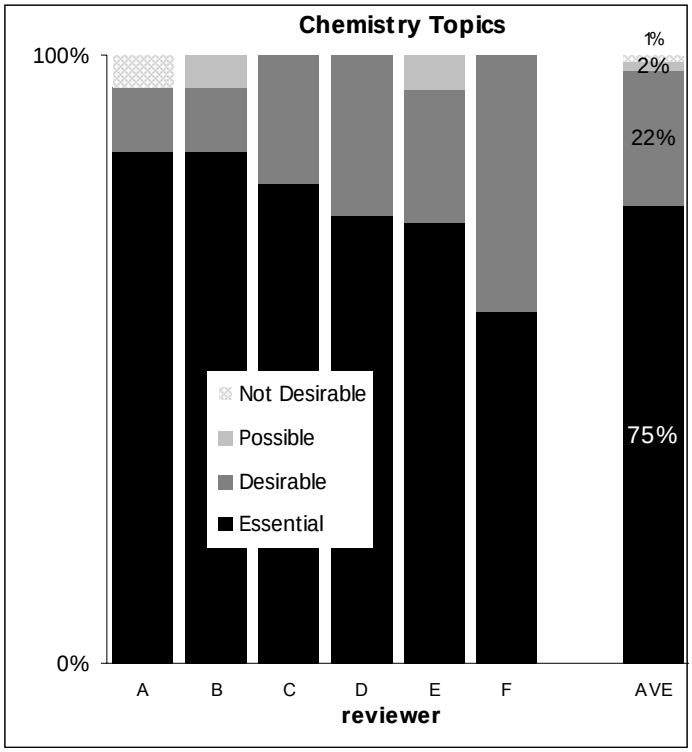


Figure 4C: Frequency of topic ratings given overall for Chemistry

Figure 5C: Distribution of topic ratings given by each Chemistry reviewer

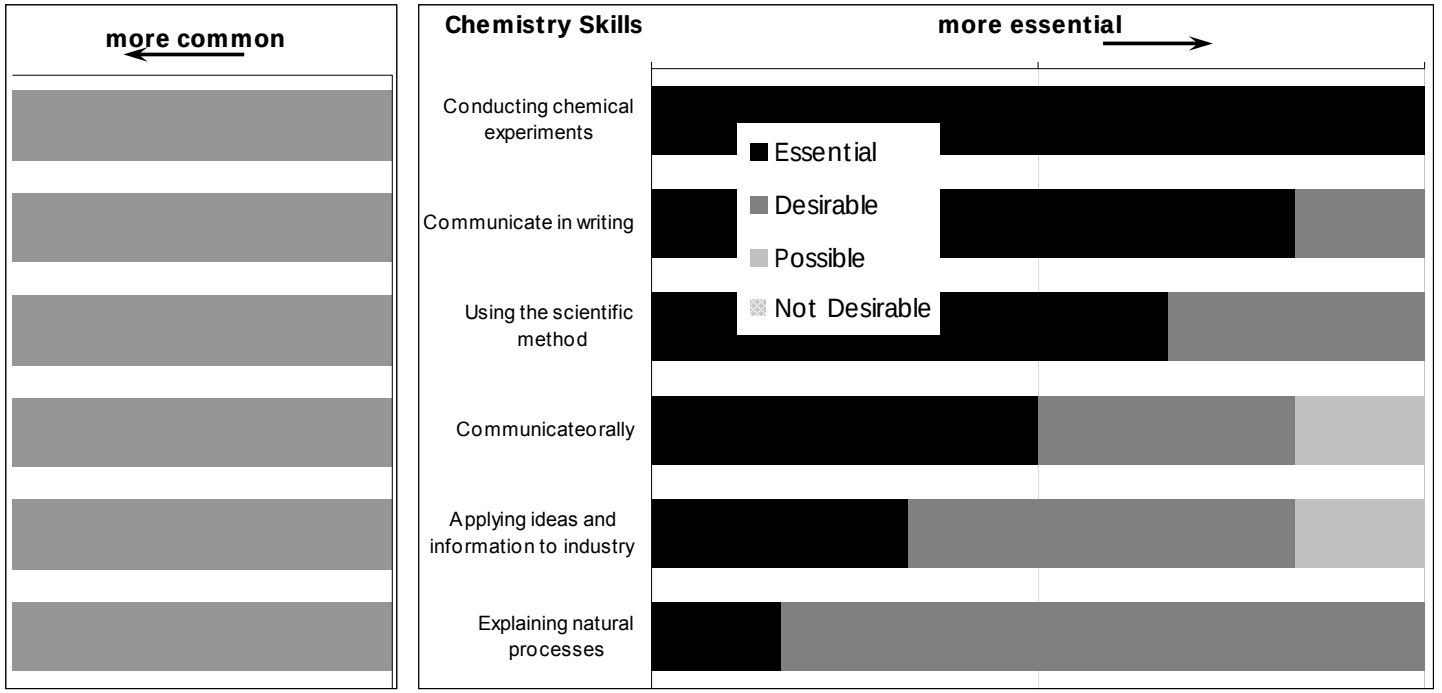


Figure 6C: Commonality of Chemistry skills from mapping

Figure 7C: Essentialness of Chemistry skills from reviewing

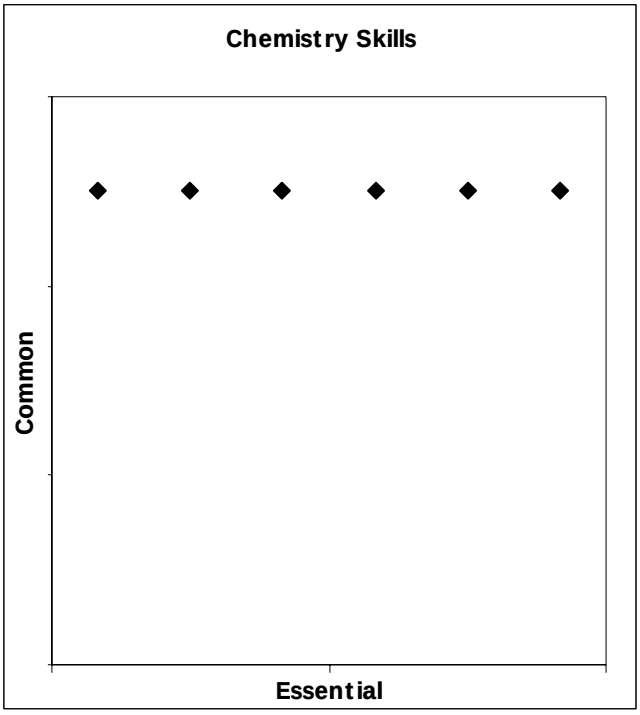
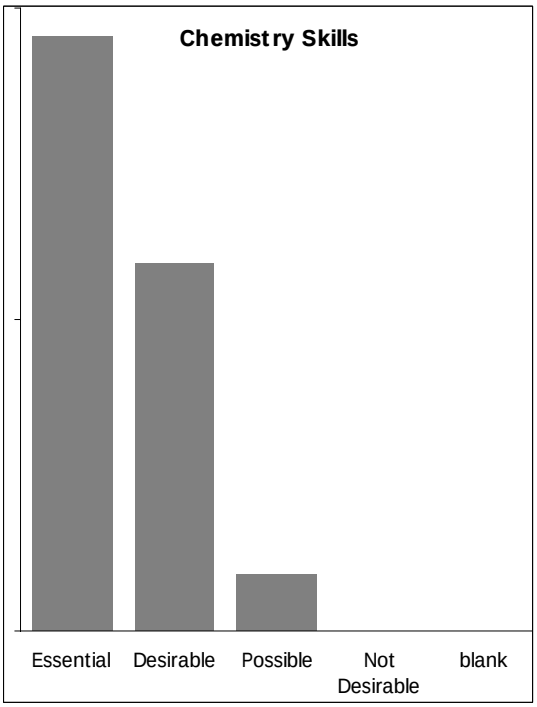


Figure 8C: Relationship between commonality and essentialness for Chemistry skills



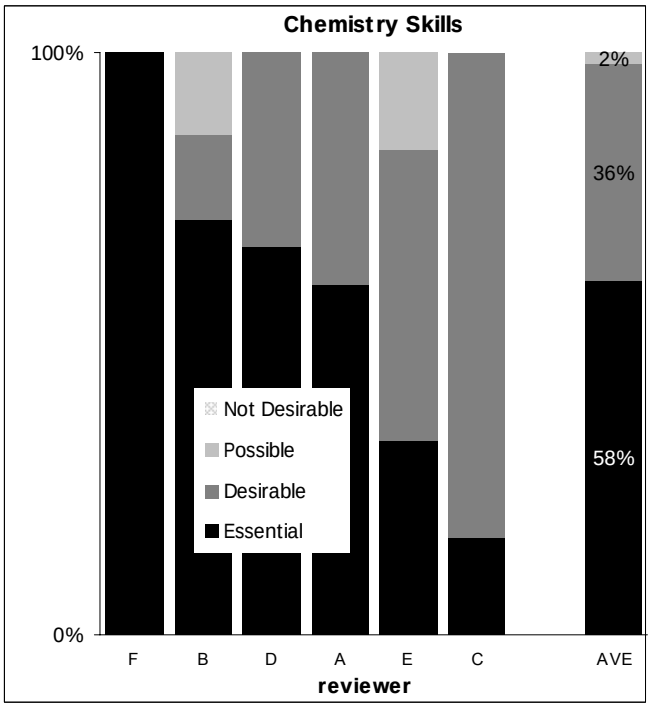


Figure 9C: Frequency of skill ratings given overall for Chemistry

Figure 10C: Distribution of skill ratings given by each Chemistry reviewer

Note: Reviewer ID is the same as for topic, which is why they are not in alphabetical order here.

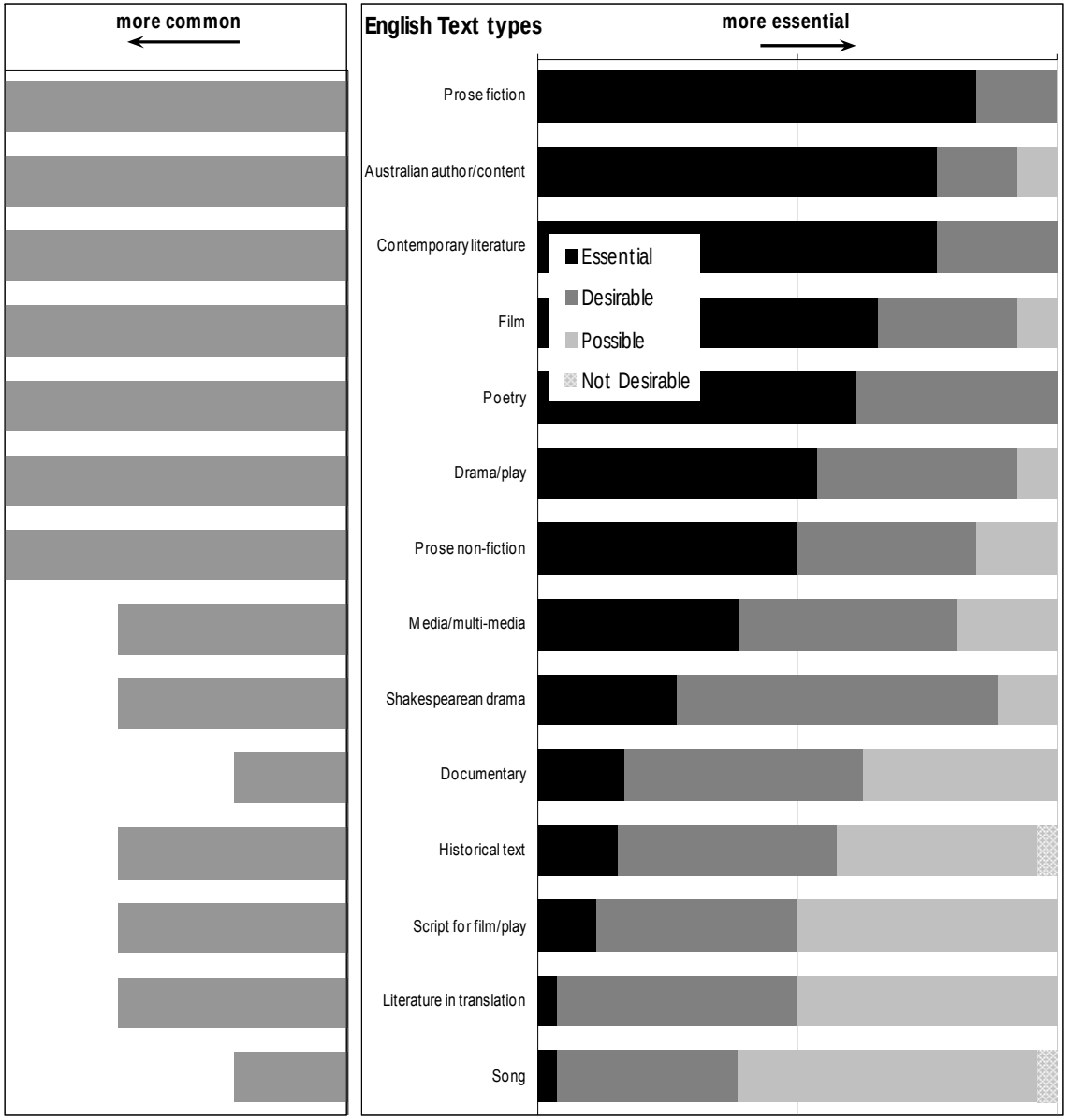


Figure 1E: Commonality of English text types from mapping

Figure 2E: Essentialness of English text types from reviewing

There appear to be three groups of text types in terms of reviewers' ratings:

1. an 'essential' group comprising the top three types (Prose fiction, Australian author/content, and Contemporary literature);
2. an intermediate group (Film to Shakespearean drama); and
3. a 'non-essential' group comprising the last five (Documentary to Song).

Most of the comments about text types in Group 3 challenge the language used to describe the text type rather than accept the existence of the text type and then rate it on the 'desirability scale'.

Comments from reviewers about text types in Group 1:

> [Prose fiction has a] complexity, breadth, depth of emotional and intellectual engagement not available in most other text types.
>
> Novels underpin the creative expression of students. Possibly the most essential of all literary forms.
>
> [Australian author/content] introduces students to perspectives on their own context—its past and/or present.
>
> Important for making connections to students' own lives, [Contemporary literature] provides access to contemporary issues and problems with use of contemporary language. Achieves relevance.
>
> Absolutely essential that students engage in reading contemporary authors in order to understand they world in which they live and also to realise there are many different ways to construct a novel or short story.

Comments from reviewers about text types in Group 2:

> [Film is] is major text from in this day and age.
>
> Undervalued by society, poetry is critical in students' learning about the richness of sound, image and texture of thought and language.
>
> Plays reflect issues in modern society. I think the more contemporary the play the better as students tend to react positively to issues raised.
>
> [Prose non-fiction] acknowledges that we interact with these sorts of texts every day (eg, reportage, editorialising) as well as contemporary 'tastes' in reading (eg, popularity of biography).
>
> [Media/multimedia] is highly desirable, not essential at this stage because of issues re digital divide but should move to essential as soon as possible.
>
> Shakespeare is appreciated by many students; however, equally, he can turn some students off. I find it easier to study if there is a good film available or if students can attend a live performance.

Comments from reviewers about text types in Group 3:

> Would not seek to differentiate documentary from film and media.
>
> [Historical text] can be burdensome for students of lesser ability but will give a broader perspective to students of contemporary English.
>
> [Scripts] – perhaps in conjunction with study of stage drama and/or film and television.
>
> I wouldn't distinguish 'translated' literature from literature that is considered good and relevant.
>
> Poetry makes this form [song] redundant in terms of study of English.

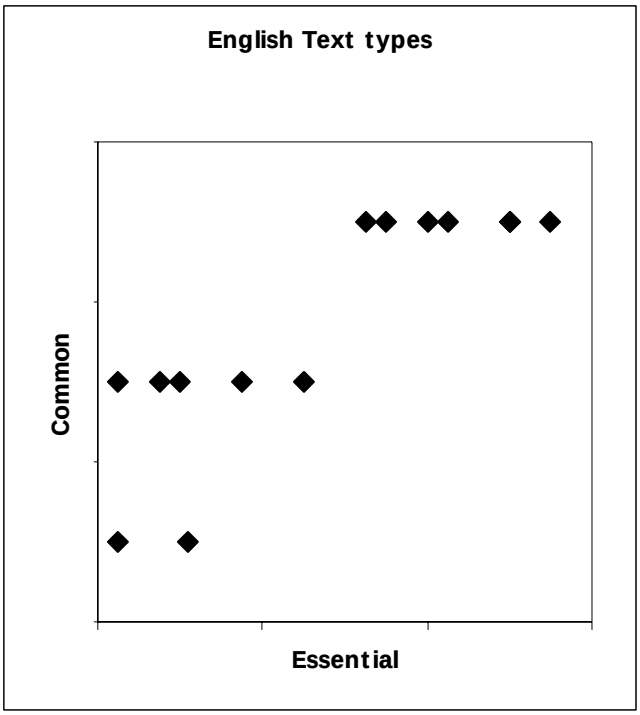


Figure 3E: Relationship between commonality and essentialness for English text types

This scatterplot shows for each text type the proportion of 'essential' ratings (horizontal axis) against how common the text type is (vertical axis). In a principled curriculum framework we would expect that how common a text type is would depend on how essential it is (or vice versa), and this seems to be the case.

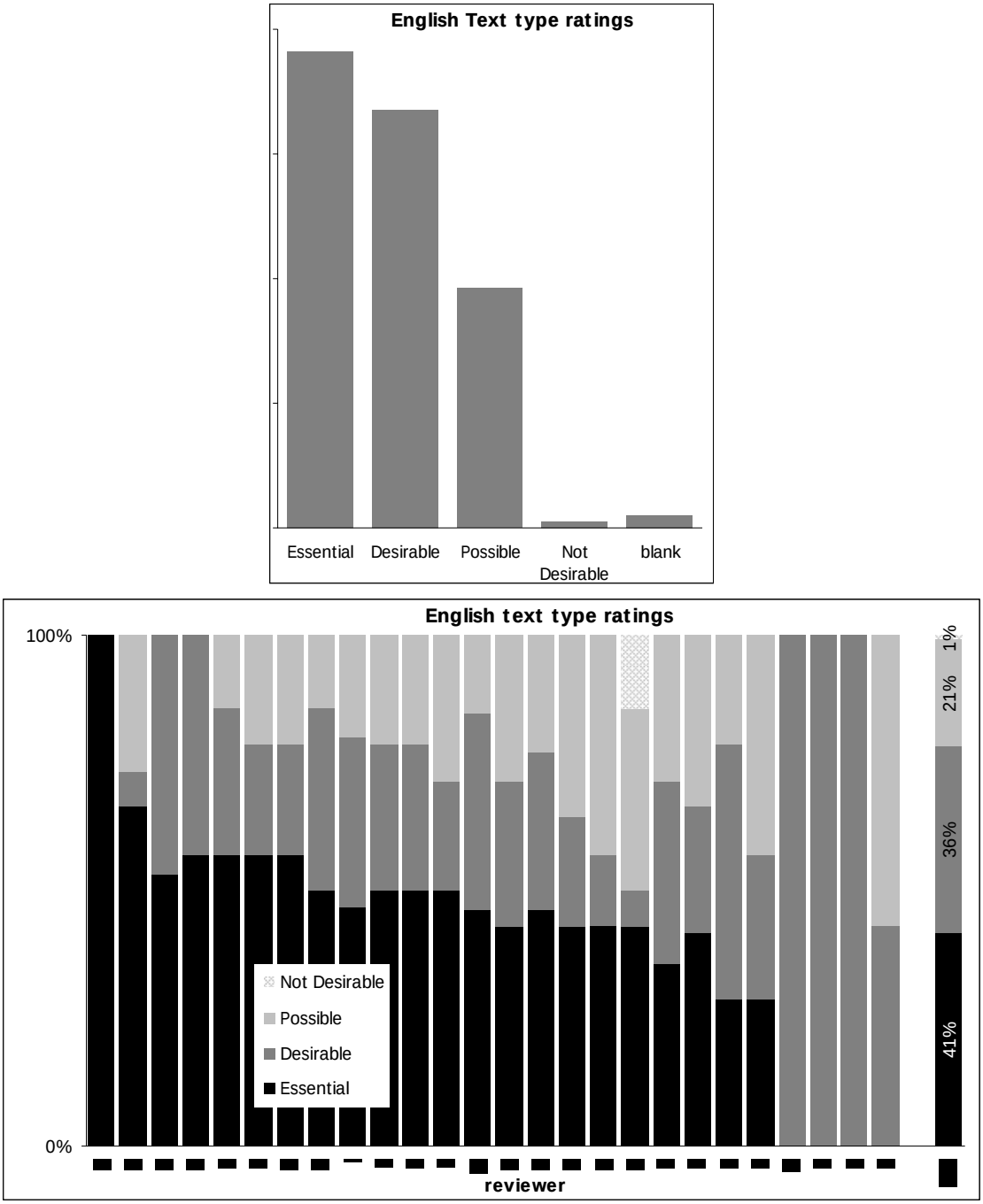


Figure 4E: Frequency of text type ratings given overall for English

Figure 5E: Distribution of text type ratings given by each English reviewer

Note: The 'blank' category in Figure 4E refers to the incidence of omitted responses.

Here, two reviewers did not provide a rating for the text type 'Documentary'.

There was variation among the reviewers in the proportion of 'essential' ratings that they gave but no indication of any distinct groups with the exception of reviewer A (an academic) as standing out by rating every text type as 'essential'.

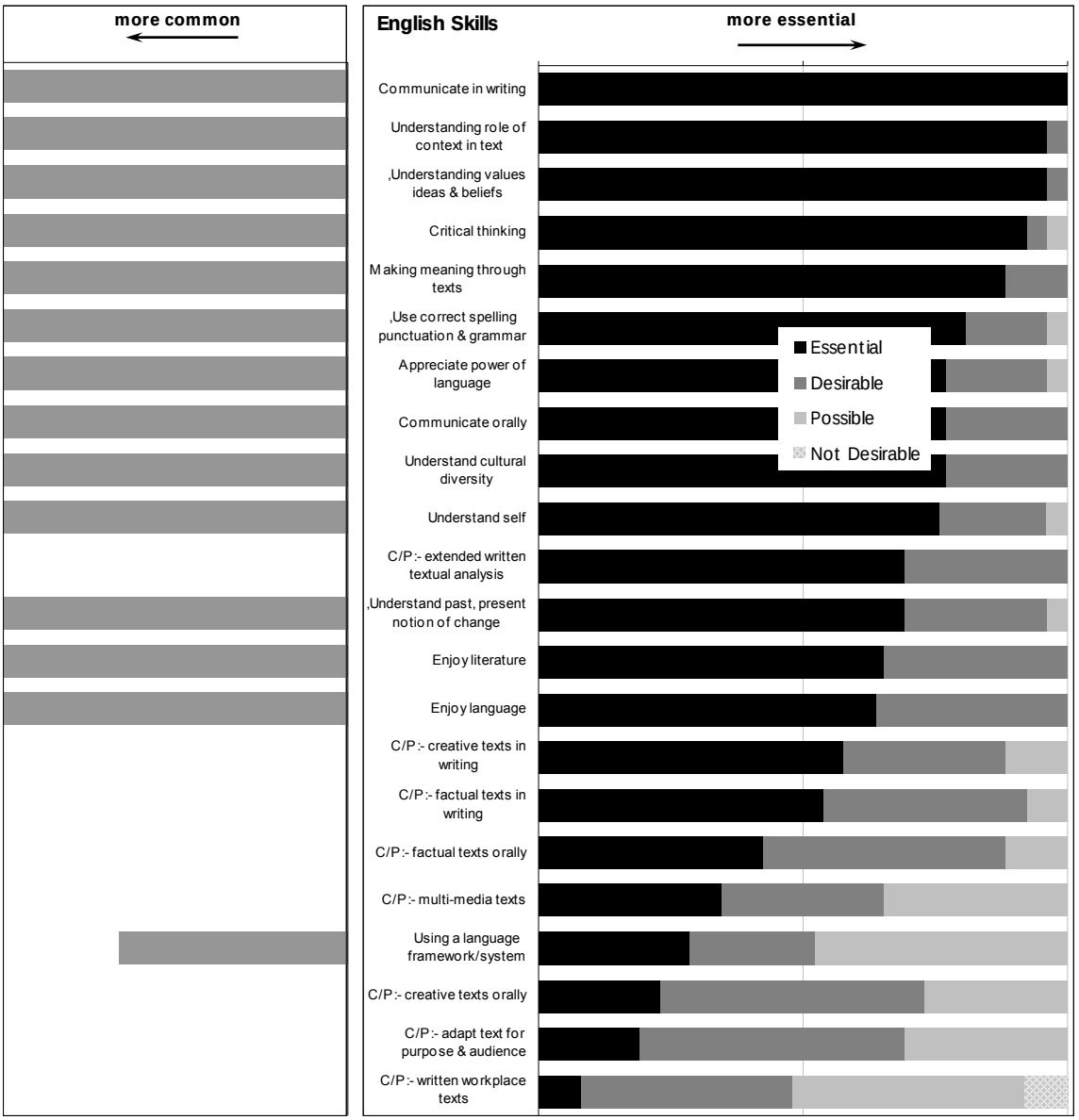


Figure 6E: Commonality of English skills from mapping

Figure 7E: Essentialness of English skills from reviewing

There is no clear grouping of skills in terms of their essentialness through the eyes of the reviewers. The top five (Communicate in writing to Making meaning through texts) appear to form the essential group. The next five (Use correct spelling etc. to Understand self) are the moderately essential group. However, the remaining twelve from a long tail that is not easily classified.

Comments from reviewers about skills in the essential group:

> It is essential that students learn how to put their ideas on paper articulately – it is a life skill.
>
> [Understanding context] is needed for students to be able to appreciate the role of purpose and audience in effective communication.
>
> [Understanding values and beliefs is] increasingly important in a multi-cultural world under threat.

English has been, and continues to be, about understanding self and the world, and the myriad perspectives we find about these in texts … Critical thinking (ie, reflection, evaluation, critique, design) bas been and needs to continue to be at the heart of English.

[Making meaning] Absolutely critical – not point working with texts if there is no meaning understood or communicated.

Comments from reviewers about skills in the moderately essential group.

[Spelling, punctuation, grammar] Desirable insofar as it assists clear communication. There is however the issue of balance – too much focus on the mechanics can be deadening and detract from higher-order thinking.

[Appreciating the power of language] Is important for students' own effective communication.

[Communicating orally] While it would seem clear that these skills should be fostered in English, they are a job for education generally. This said, an English classroom in which rich communication was not fostered would be a sad place.

[Understanding cultural diversity] – No comments made

[Understanding self] – No relevant comments made

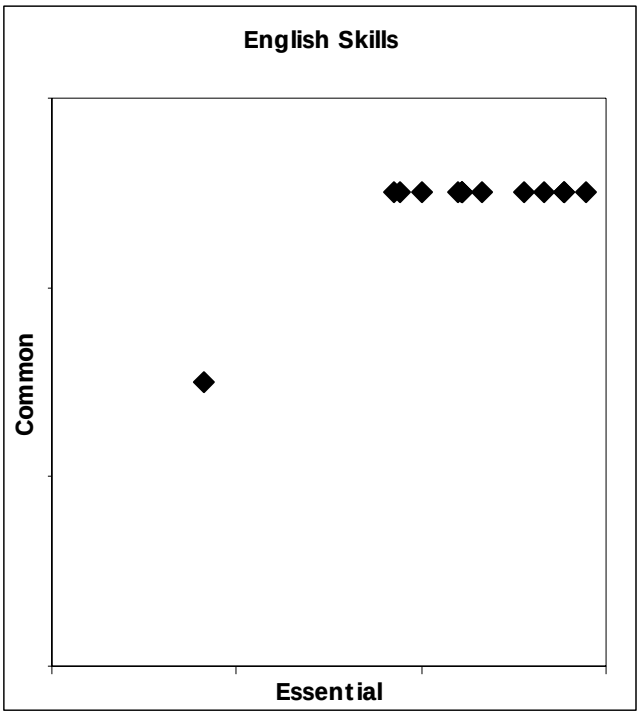
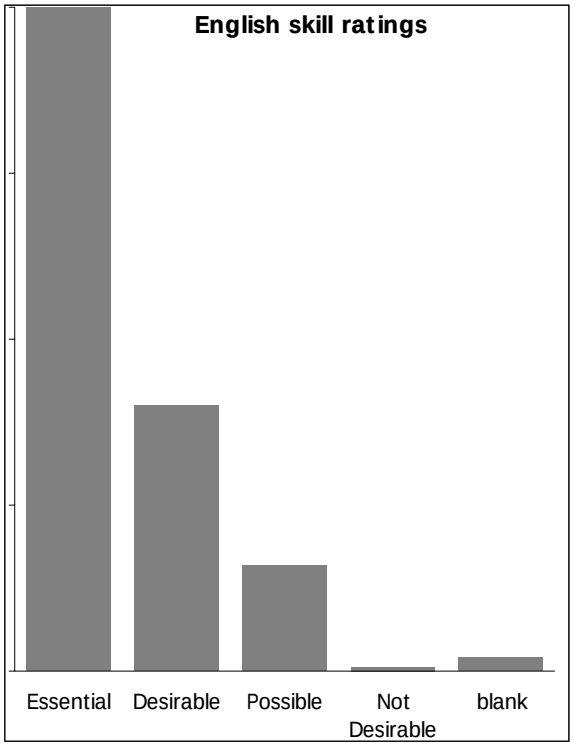


Figure 8E: Relationship between commonality and essentialness for English skills

This scatterplot shows for each skill the proportion of 'essential' ratings (horizontal axis) against how common the skill is (vertical axis). In a principled curriculum framework we would expect that the skills deemed to be essential would be common (or vice versa). However, this is not the case. Every one of the skills (except one, Using a language framework/system) is present in all curricula across the country but they are not all deemed to be essential.



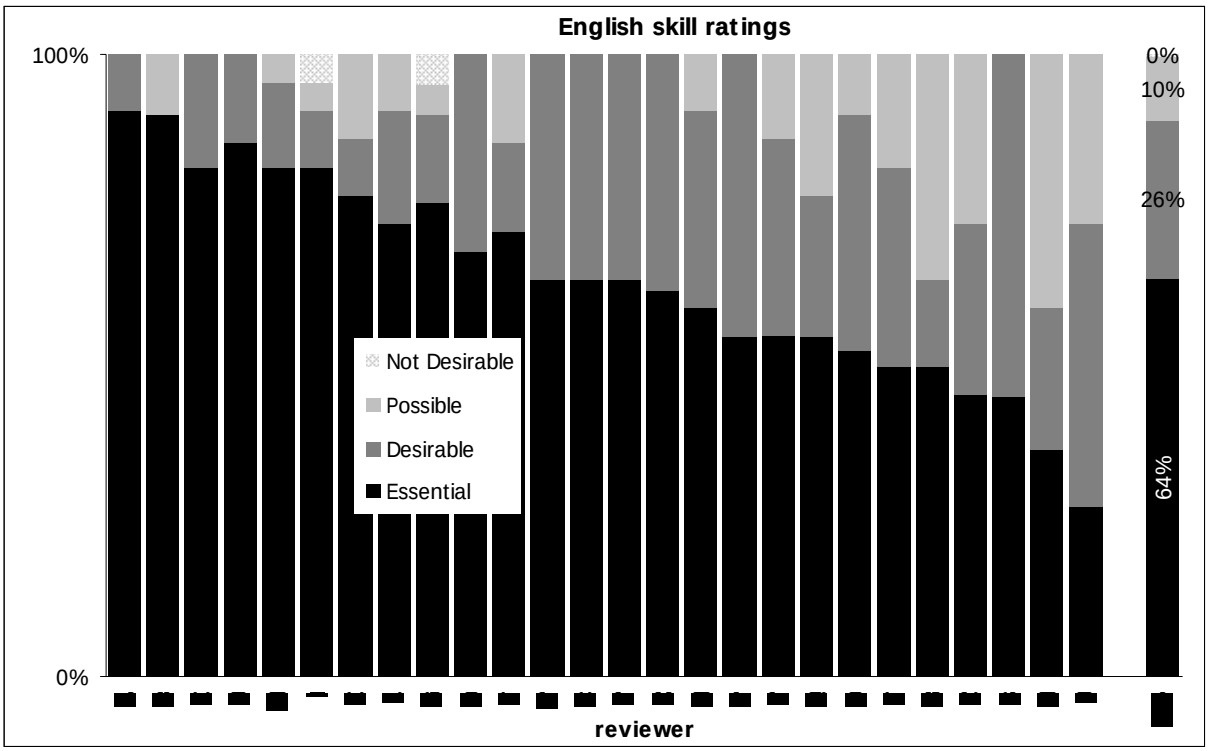


Figure 9E: Frequency of skill ratings given overall for English

Figure 10E: Distribution of text type ratings given by each English reviewer

Note 1: Reviewer ID is the same as for topic, which is why they are not in alphabetical order here.

Note 2: The 'blank' category in Figure 9E refers of omitted responses.

Here, some reviewers did not rate the topic, 'Using a language framework system', as essential, desirable etc. because, in their own words, 'How could you use language without doing this?' and 'I don't know what is meant by this.'

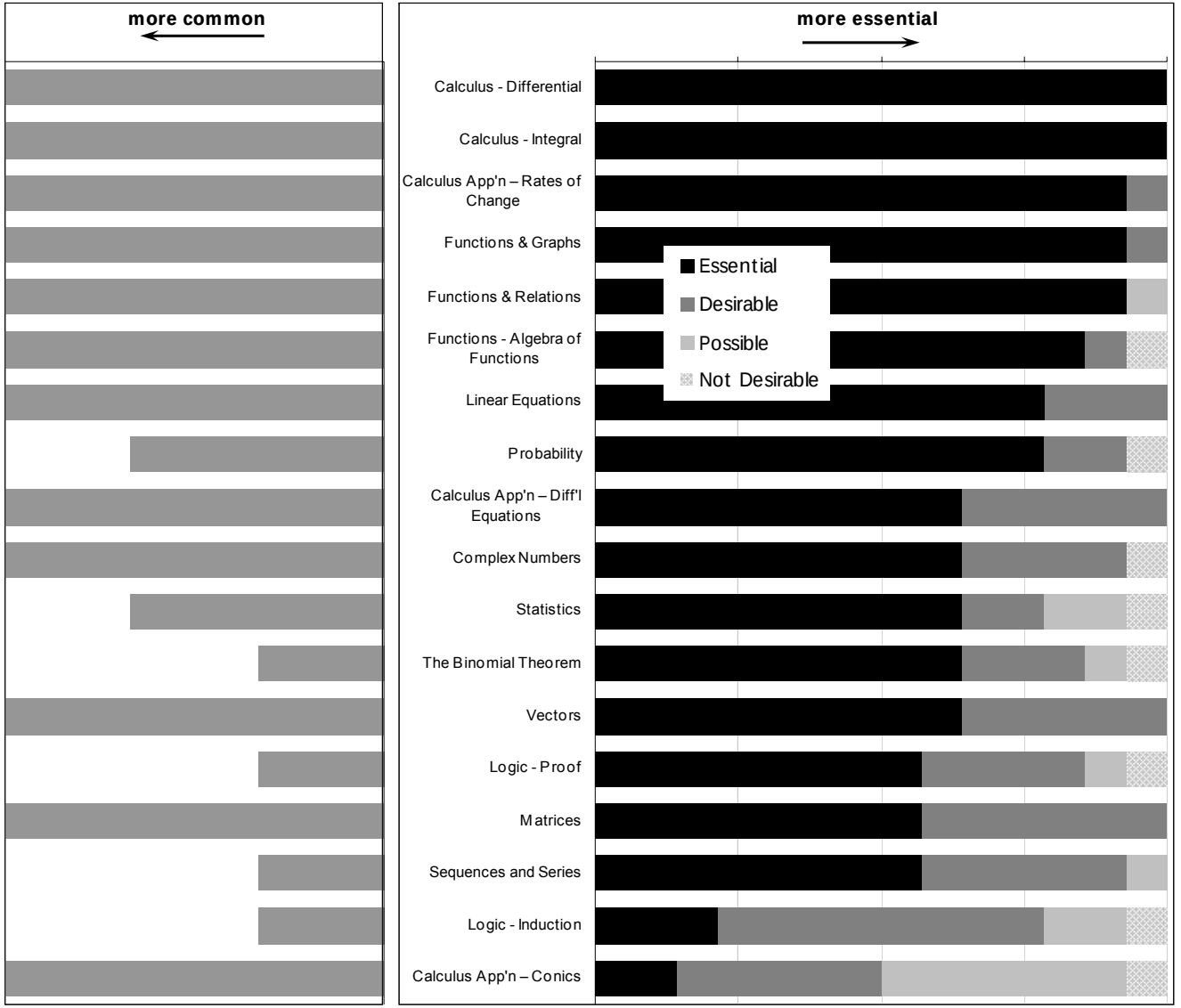


Figure 1M: Commonality of Mathematics topics from mapping

Figure 2M: Essentialness of Mathematics topics from reviewing

With Mathematics there are three discernible groups of topics when rated by essentialness.

The first group is ‘essential’ and is made up of the top eight topics in Figure 2M (Differential calculus to Probability). This is what reviewers said:

> I regard calculus and the basic study of rates of change fundamental at this level. It has so many applications in other areas and so much connection to reality.
>
> Probability and statistics are really important for applications in many fields and basic understanding of them should be in all mathematics courses.
>
> Composition of functions is essential for calculus. Inverse functions contribute to a broad picture of fields.

The second group is ‘moderately essential’ and is made up of the next eight topics (Differential equations to Sequences & series).

> Exposure is essential but treatment should be limited or be related to straight forward case only.” “Interesting [complex numbers] — could be left until uni, students do not see applications.
>
> Very important to understand some of the basics [statistics]
>
> [Binomial theorem] provides a useful structure for expansion and has application in probability as well
>
> [Vector]—systems and basis for many aspects of engineering and applications of mathematics
>
> It is highly desirable that students are exposed to proofs before reaching university.
>
> Although not essential as they can be introduced at University, matrices introduces a field with different properties to number systems, and hence gives students a more coherent view of mathematics.
>
> Students need to be familiar with arithmetic and geometric sequences and series at least to ease into more advanced analysis at later stages.

The third group is ‘non-essential’ and is made up of the last two topics (Inductive logic and Conics).

> One of the forms of proof but one that students do not easily understand at this stage.
>
> I enjoy conics but they are not as relevant as some other areas of mathematics.
>
> I have rarely used this [conics] in 30 years.” “I suspect conic sections has traditionally been included because teachers enjoy it. In my experience students don’t!

Conics is notable in being deemed not essential by all reviewers yet included in almost all curricula in Australia.

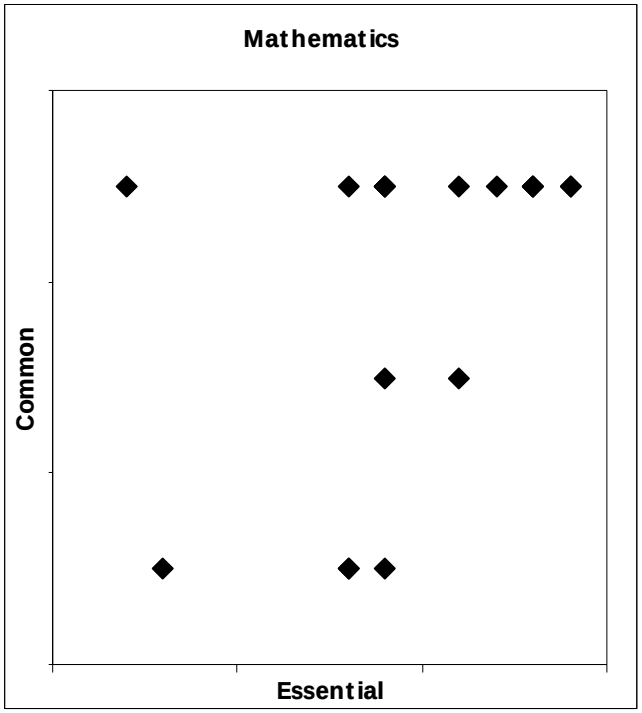


Figure 3M: Relationship between commonality and essentialness for Mathematics topics

There are two topics deemed not to be very essential in Mathematics at senior level. One is Conics (discussed on previous page) and represented by the diamond in the top left-hand corner of Figure 3M. The other is Inductive Logic, represented by the diamond in the bottom left-hand corner. Unlike Conics, Inductive Logic is not found in many curricula across the country.

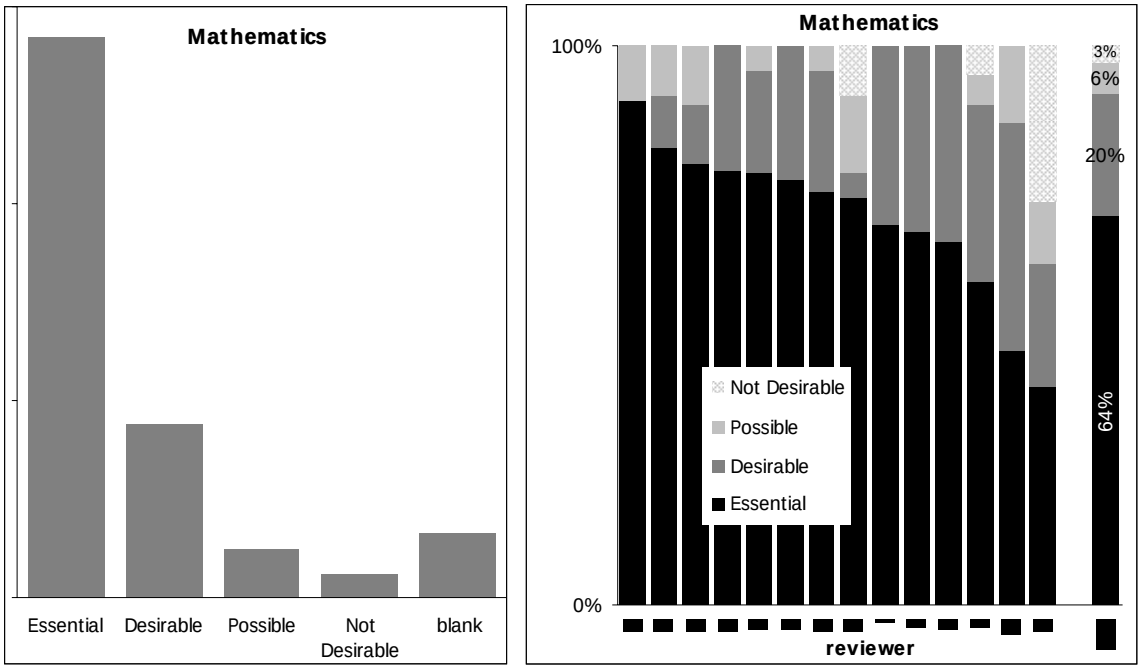


Figure 4M: Frequency of topic ratings given overall for Mathematics

Figure 5M: Distribution of topic ratings given by each Mathematics reviewer

Note: The 'blank' category in Figure 4M refers to the incidence of omitted responses. The apparently large omit rate is an artefact of table layout in the original task, as a result of which some reviewers gave ratings for category headings (Calculus, Functions, Logic, Polynomials) as well as for the elements within.

Although there was variation among the reviewers in the proportion of 'essential' ratings, no discernible groups can be identified. For the mathematically inclined, the distribution of essential ratings follows the normal distribution.

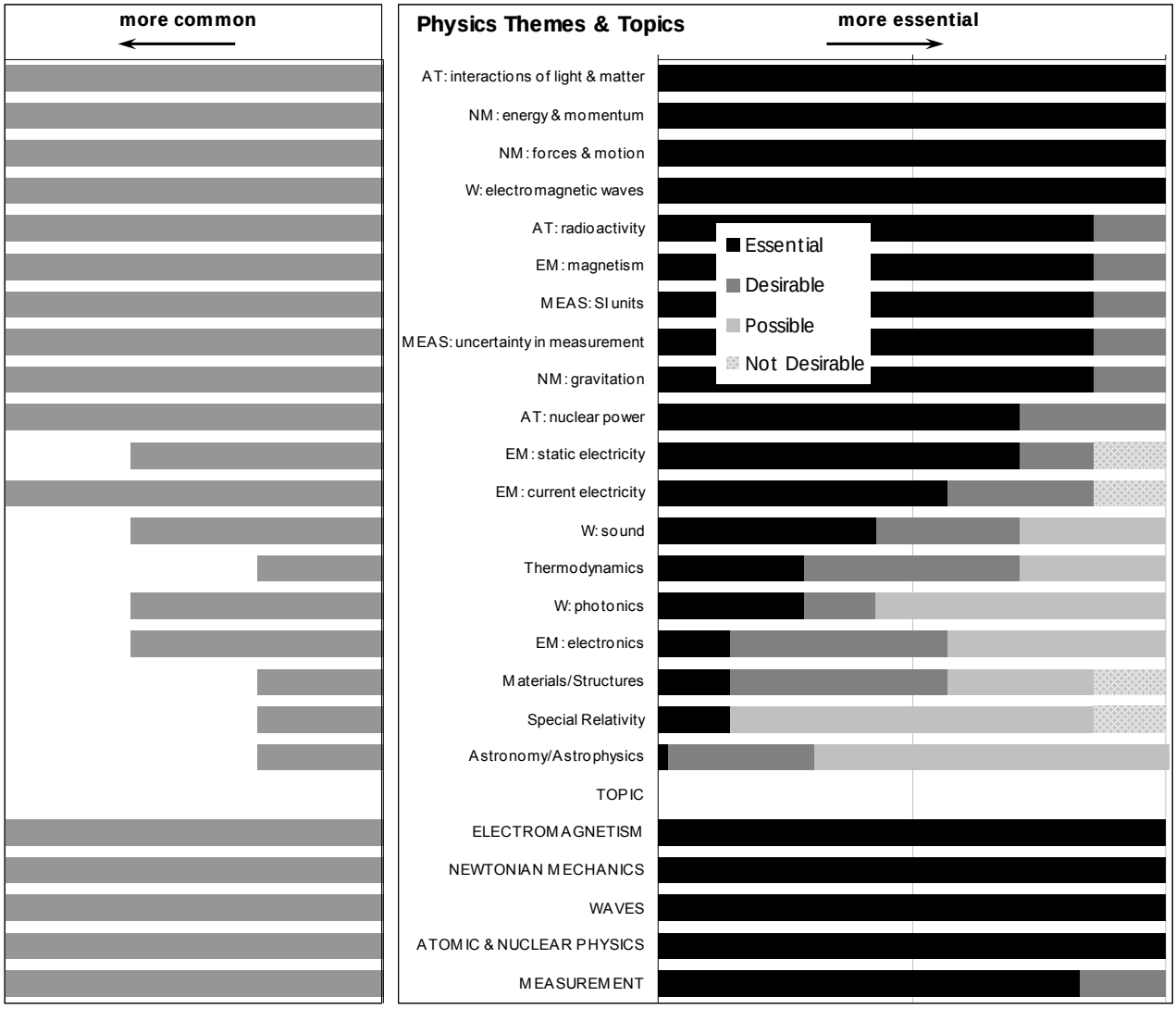


Figure 1P: Commonality of Physics topics from mapping

Figure 2P: Essentialness of Physics topics from reviewing

With Physics there are four discernible groups of topics according to ratings of essentialness.

Group 1 ('essential'): The top four, from Atomic Theory: interactions of light and matter to Waves: electromagnetic wages);

Group 2 ('moderately essential'): Next five topics, from Atomic Theory: radioactivity to Uncertainty in measurement;

Group 3: ('not essential'): Last four topics, Electronics to Astronomy/astrophysics.

The topics not included in these three groupings could be called 'intermediate' in essentialness but they are sufficiently dissimilar to not be grouped.

Comments from reviewers about topics/themes in Group 1:

[Atomic Theory: interactions of light and matter] Also a key area of Physics that helps us understand and explain a wide range of different physical phenomena.

[Energy and momentum] – No relevant comment.

[Force and motion] – No relevant comment.

[Waves: electromagnetic waves] The 'electromagnetic' idea is also valuable since it allows the important connection between the light and wave ideas and the properties of electricity and magnetism – one of the great unifying ideas of Physics with real historical importance.

Comments from reviewers about topics/themes in Group 2:

[Atomic Theory: radioactivity] An understanding of the facts associated with radioactivity, rather than the uninformed emotional responses, is important in making appropriate decisions about energy needs.

Magnetic fields (and their creation by currents) and magnetic forces on currents and moving charges are fundamental.

[SI units are] a key foundation stone to all experimental science.

[Uncertainty in measurement is] also a fundamental experimental skill students should understand.

[Gravitation] – No relevant comment.

Comments from reviewers about topics/themes in Group 3:

[Electronics] if time were available but general electrical theory must precede study of electronics.

[Materials/structures] could be part of an option or elective, but not needed as part of the core of an elementary Physics course.

[Special relativity] has intrinsic interest for many students but is not an essential building block …

Astronomy more suited to lower levels and there are more important topics to cover.

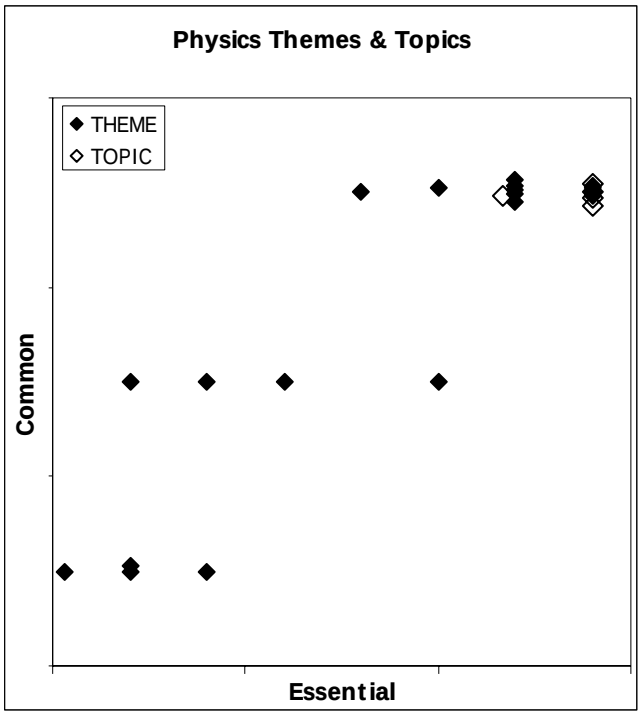


Figure 3P: Relationship between commonality and essentialness for Physics topics

Note: A random 'jitter' is applied to points in the scatterplot that overlap.

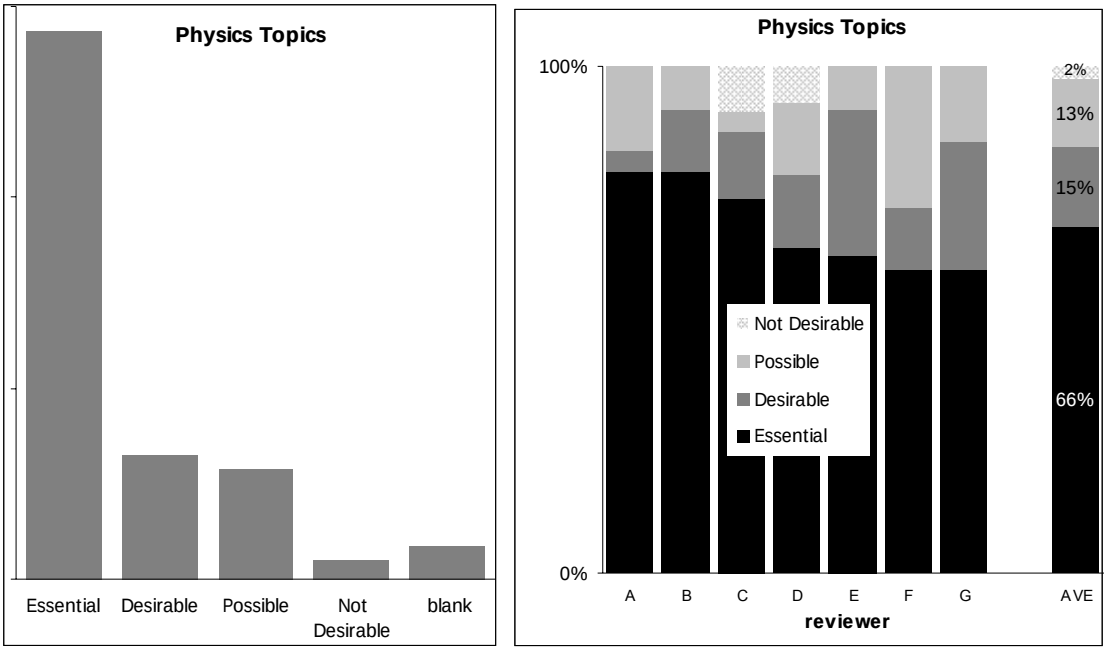


Figure 4P: Frequency of topic ratings given overall for Physics

Figure 5P: Distribution of topic ratings given by each Physics reviewer

Note: The 'blank' category in Figure 4P refers to the incidence of omitted responses. The apparently large value here is an artefact of the table layout in the task, as a result of which some reviewers gave ratings for both headings and elements within.

The scatterplot shows for each topic/theme the proportion of 'essential' ratings (horizontal axis) against how common the topic/theme is (vertical axis). In a principled curriculum framework we would expect that how common a topic/theme is would depend on how essential it is deemed to be (or vice versa), and this is broadly the case here.

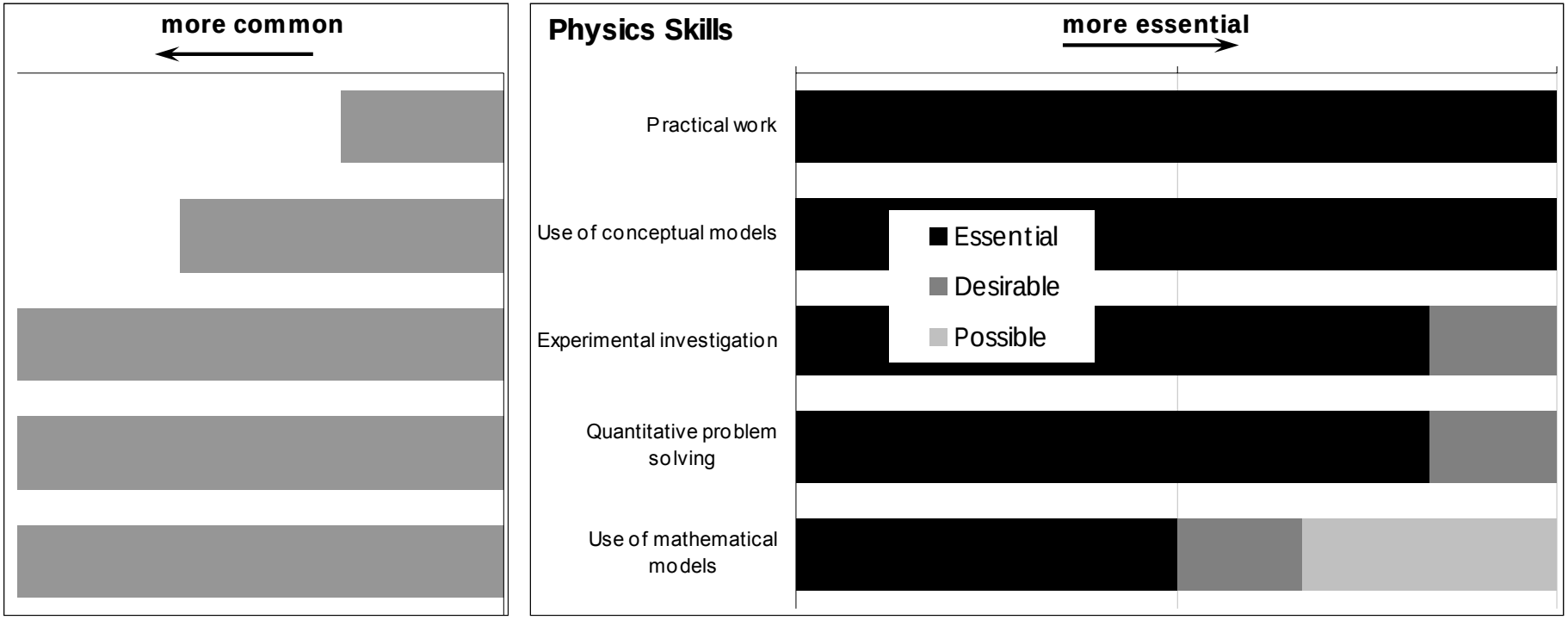


Figure 6P: Commonality of Physics skills from mapping

Figure 7P: Essentialness of Physics skills from reviewing

Some comments from reviewers about Physics skills

Re practical work:

> This is of course vital – Physics involves measuring, comparing etc., and students must become familiar with this.

Use of conceptual models:

> Models are a fundamental way in which science works. Conceptual models can also be used to come to appreciate the development of science and to see it as a human endeavour.

Experimental investigation:

> Experimental investigation includes the thinking involved in formulating hypotheses from a combination of inductive and deductive reasoning.

Quantitative problem solving:

> Essential that students learn to apply their Physics knowledge to topics/themes outside the realm of the course outline.

Use of mathematical models:

> Fundamental mathematical skills relevant to problem solving are of more importance to me.

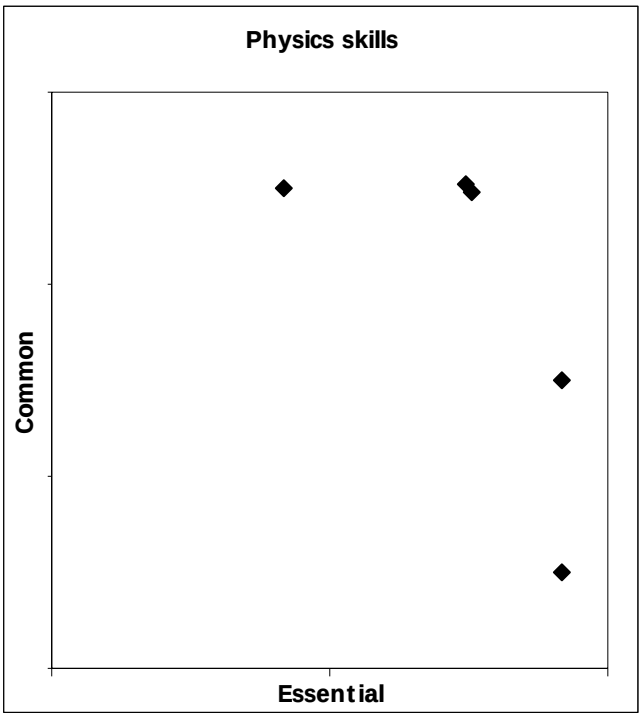
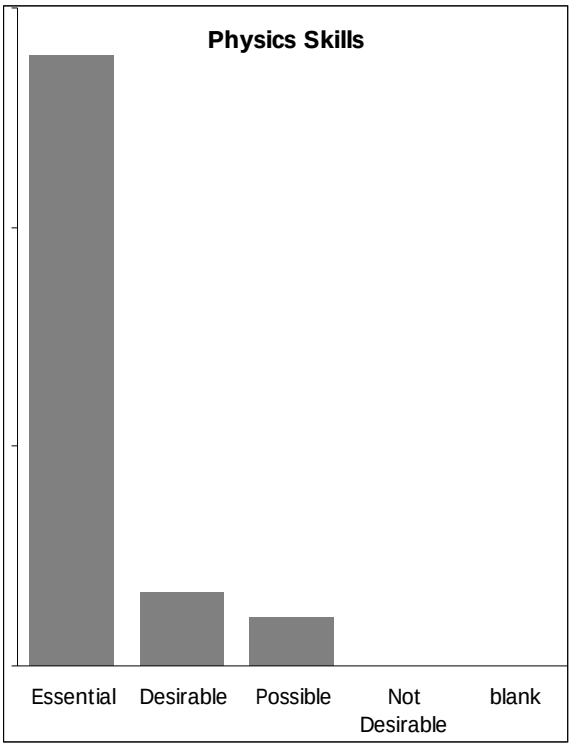


Figure 8P: Relationship between commonality and essentialness for Physics skills

The scatterplot shows for each skill the proportion of 'essential' ratings (horizontal axis) against how common the skill is (vertical axis). In a principled curriculum framework we would expect that commonality depends on essentialness (or vice versa), but this is not the case here: The skills rated more essential are less common.



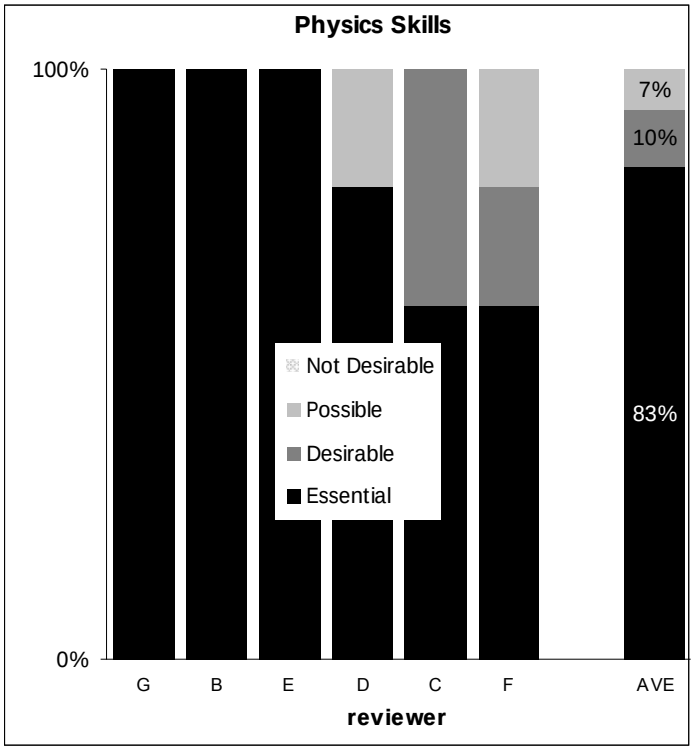


Figure 9P: Frequency of skill ratings given overall for Physics

Figure 10P: Distribution of skill ratings given by each Physics reviewer

Note 1: Reviewer ID is the same as for topic, which is why they are not in alphabetical order here.

Note 2: One reviewer (A) did not complete skill ratings.

Category of reviewer

In only two subject areas, Mathematics and English, are there discernible differences in the proportion of ratings given by reviewers from different response categories (teacher, teacher-educator, university discipline specialist, and professional from the community).

In Mathematics, teacher practitioners rated three topics as more essential than did teacher-educators. The topics are matrices, linear equations, and differential equations.

For English, there were differences in the incidence of 'essential' ratings for text types, with the academics and teacher-educators giving fewer 'essential' ratings and more 'desirable' ratings than did teacher-practitioners and professionals from the community.

	Academic higher than …	Teacher-educator higher than …	Practitioner and Community professional higher than …
Academic lower than …		On Contemporary literature	On Prose fiction Prose non-fiction Contemporary literature
Teacher-educator lower than …			On Drama
Practitioner and Community professional lower than …			

Conclusion

Teachers, teacher-educators, university discipline specialists, and community members reviewed and rated the importance of current curriculum content and identified other content that they considered important but missing from current curricula.

In Physics, almost all topics identified as 'essential' by the majority of reviewers are present in all state and territory curricula. The only exception is the topic Static Electricity & Electronics, which was judged essential by the majority of reviewers but is not included in all state/territory curricula.

In Chemistry, the same topics appear in almost all state and territory documents and almost all were considered essential by the majority of reviewers. Two exceptions are Analytical Techniques and Gases in the Atmosphere, which appear in only some curricula. Analytical Techniques was rated 'essential' by almost all reviewers. On the other hand, while all states and territories include in their Chemistry curricula the historical development of atomic theory, none of the reviewers considered this topic essential.

In Mathematics, a list was developed of all topics covered in senior mathematics courses, and reviewers were asked to rate how essential each topic was for inclusion in the highest-level mathematics course. Almost all mathematics topics judged 'essential' by the reviewers appear in almost all state and territory highest-level mathematics curricula. The exceptions are The Binomial Theorem, Logic Proof, and Sequences and Series, which most reviewers considered 'essential' but are mentioned in a minority of advanced courses. (It is possible that, in some states, advanced mathematics students are exposed to these topics in other, complementary, mathematics courses). One topic—Application of Calculus to Conics—is mentioned in all advanced courses but was not considered essential by the majority of reviewers.

In Australian History, reviewers were less inclined than in Chemistry, Physics and Mathematics to identify specific topics as 'essential' for all students to study. There is no history topic that all reviewers considered essential to the senior curriculum. The topics considered most important are: The Nature and Impact of Immigration, Foreign Policy and Changing Relations, and The Social and Economic Impact of World War I. Reviewers were more inclined than for the other four subjects to identify additional topics that they believed students should study (eg, the Vietnam War and Protest).

In English, seven text types are mentioned in all state and territory documents as possible text types for student study. These seven text types also were considered by the reviewers to be the seven most essential text types for student study. Of these, Prose Fiction was judged most essential, followed by Contemporary Literature. A majority of reviewers considered Poetry essential. The other four text types mentioned in the top seven are Australian author/content, Film, Poetry, Drama/Play (the last-mentioned category being separate from Shakespearean Drama), and Prose non-Fiction. Most reviewers rated Shakespearean Drama 'desirable' but not 'essential'. Only a minority of reviewers rated the study of multimedia texts 'essential'.

Many of the English skills/understandings rated 'essential' by the reviewers appear in all state and territory English curricula. Rated most essential was 'communicating in writing', followed by 'understanding the role of context in text', 'understanding values, ideas and beliefs', and 'making meaning through texts'. The majority of reviewers considered good control of spoken and written English to be a crucial component of English courses. Some expressed the view that the senior English curriculum is not the only or best place for attention to linguistic accuracy; some described these as skills that should be developed in the earlier years of school; and some considered further instruction in these skills in the senior secondary years to be impractical because of time constraints.

Chapter 4 – Achievement standards: Are they comparable?

Underpinnings of assessment and standards

Two of the most significant differences in assessment arrangements across the country are in the underpinnings of assessment and standards and in the calculation of rank orders for university selection. These differences (and many of the others that exist) are grounded in the history of the states/territories and their education systems and in the different sets of compromises that have had to be struck with their respective stakeholders over time. Whatever the reasons for the differences and however well achievement standards are specified and applied in the various jurisdictions, such significant differences might be indicative of differing standards of achievement across the country.

There are differences in key assessment practices in the senior secondary years, with variations in the balance of external examinations and school-based assessments across and within states and territories. In this discussion, the term external assessment is reserved for subject-specific examinations set by a body external to the school, as exemplified by the HSC in New South Wales. Such examinations are devised to assess student achievement in a particular subject, whether by objective-type or by conventional written, oral or practical questions. All the questions refer to a syllabus that has been defined by a group of educators (including teachers and/or examiners).

Internal (school-based) assessment is devised, constructed and implemented by schools, sometimes based on an official syllabus and accredited work program, sometimes not. Teachers have to be trained to become consistent judges of the quality of student work and there has to be a quality assurance process in place to guarantee comparability of results. A side-effect of such processes is that teachers engage in professional conversations about curriculum, pedagogy and standards.

There are no external examinations in the ACT. Queensland has operated a system of externally moderated school-based assessment since the abolition of public examinations (set by The University of Queensland) in 1972. The other six jurisdictions have a combination of external examinations and internal assessments, and there have been changes in the relative weightings of external and internal assessment over time. The current arrangements in New South Wales, for example, are 50 per cent external and 50 per cent internal. South Australia has 100 per cent internal for Stage 1 (usually Year 11) and 50 per cent internal for Stage 2 (usually Year 12). Because Queensland and New South Wales represent historical extremes in the relative weightings of external and internal assessments, they will be cited as examples of various phenomena in this chapter with disproportionate frequency.

Whatever their assessment regime, all systems recognise the value of using a range of assessment methods although different modes of assessment dominate in different jurisdictions. Assessment instruments used include formal examinations, written assignments, projects, practical work, oral presentations, aural tests (languages), end-of-semester tests, field work, and the creation of artefacts. The conditions for assessment cover the whole gamut: supervised or unsupervised, point-in-time or continuous, within prescribed dates or not, paper-based or computer-based, open- or closed-book,

once-off or revisions allowed, and so on. Sometimes this variation is a function of the subject, sometimes it is a function of the assessment regime. For written assessments, the format of the assessment task might be multiple-choice, constructed response or extended response such as written expression or symbolic data manipulation. The wide range of assessment methods used is a response to the diversity of subjects now on offer, many of which do not lend themselves to point-in-time pen-and-paper tests. Overall, there has been 'a change in emphasis over recent years with a shift towards assessment instruments that emulate the kind of process-based higher-order tasks thought to represent good practice' (Shepard, 1991).

At the present time, no national standards exist. At the state/territory level there has been an attempt to develop more explicit statements of achievement standards but those jurisdictions do not have the same way of expressing standards for assessment and nor are those standards, however expressed, equivalent from state to state. For example, in New South Wales, the HSC provides detailed information about students' levels of achievement in relation to explicit standards and the cohort taking each subject. In Queensland, standards descriptors for each exit level of achievement are published in the corresponding syllabus document.

In describing the processes for judging the quality of student work at the task/test/examination level and for grading student performance at the certification level, the states/territories use terms such as criteria-based, standards-based, and standards-referenced.

After the McGraw Report of 1996, New South Wales moved from normative towards standards-referenced assessment and reporting; that is, from assessing and reporting student performance relative to that of other students in the cohort to giving meaning to marks assigned to student work by referencing the image of the work to pre-determined standards of performance.

After the 1978 Review of School-Based Assessment (ROSBA) in Queensland, norm-based assessment was replaced with criteria-based assessment; that is, it changed from assigning grades according to the normal distribution to assigning grades after focusing on the specific nature of a student's actual achievements in relation to specific criteria.

Maxwell (2001) collapses under five headings the various usages of the term 'standards' in relation to educational assessment and reporting. In summary, standards could be:

1. moral or ethical imperatives (what students should do);
2. legal or regulatory requirements (what students must do);
3. quality benchmarks (what is expected of students);
4. arbiters of performance quality (defining success or merit in student work);
5. learning milestones (progressive targets for student learning).

Number 4 (defining success or merit) matches the definition of *achievement standard* (the 'how well' of student performance). It is the sense of how well that characterises the standards-referenced/based approach that now operates at the senior level in most jurisdictions. South Australia, for example, provides criteria for judging performance and performance standards in their Curriculum Statements, Parts I and II, respectively.

Analysis of achievement standards across the country

In this study's examination of achievement standards in five subjects across eight jurisdictions on the basis of written documentation, only the standards that relate to the highest possible grade in each jurisdiction are considered. The communication of standards via verbal descriptions (without instantiation of standards) and the way standards statements are written and applied across the country limit an understanding of what students are expected to achieve in the subject. For example, the way in which the minimum acceptable performance level 'floats' across the country precludes any sharing of views about what constitutes the baseline for minimum acceptable standard.

As part of the work to understand the highest level of achievement defined for each subject in each jurisdiction, available descriptions of standards were compared and contrasted across states/territories, and evaluated. For example, in New South Wales, descriptions of Band 6 achievement in the each of the five subjects were obtained and analysed; in Queensland, descriptions of Very High Achievement in each of the five subjects were obtained and analysed. Analytical frameworks were designed in order to compare standards in the same subject across the country. The term 'aspirational standard' is used to describe achievement at the highest level.

Four different methods are used for analysing aspirational standards in five subjects across the country. Physics and Chemistry are analysed in a similar way. The highly differentiated subject, Mathematics, is analysed first.

Mathematics

This analysis is based on the most recent highest-level mathematics courses (called 'sigma' courses in Chapter 2) in the states and territories (see Table 1M in Chapter 2 for names of courses). The way Barrington (2006) defines 'advanced' mathematics is the same as the way we refer to here as 'highest-level' mathematics courses; that is, as those 'generally taken by students who wish to proceed to tertiary studies which require the strongest of mathematical preparation, such as engineering, actuarial studies, mathematics, statistics, physical sciences'. In New South Wales this group of students would be studying Mathematics Extension 1 and possibly Extension 2. In Queensland this group of students would be studying Mathematics C.

Comparability of aspirational standards in highest-level mathematics is considered in two ways, each of which requires on-going explanation and exemplification.

Comparing achievements is not simply a matter of considering the quality of performance in a particular criterion (or aspect of mathematics)—'the measurement of achievement along the measuring scale'. It is first a matter of comparing *what* is being measured, the 'measuring scales' themselves. The more comparable the measuring scales used, the more it make sense to compare actual achievements along the measuring scales. We refer to the 'what' is being judged or measured as *aspects* of mathematics performance.

Comparability of aspects of mathematical performance

What are the similarities and differences in what is being valued and measured as we move our attention from jurisdiction to jurisdiction? Our response to this question takes into account three inherent complications.

The first is that it is possible for two assessment regimes to value much the same sorts of things, but differences in the organisation of the aspects of assessment might conceal this.

The second is that, even though the same achievement aspects might be in play, it is often the case that they are not equally emphasised; that is, an aspect of performance that has been deemed critical to achieving well under one regime might be considered of minor importance, if not peripheral, in another. It is not that the aspect is not valued in both cases but that it is not **as** valued.

Third, it is conceivable that a student might perform extremely well in one aspect even though the particular assessment regime does not place any or much value on that aspect. A simple example, here, is that, by availing themselves of the opportunities provided by a course, students might offer particularly creative, unexpected or elegant solutions to mathematical problems. The assessment regime, however, might only value the fact that a solution has been found.

Appendix 5 contains the aspects of mathematics performance (criteria for assessment), together with the aspirational standards descriptors or their 'best equivalent', which are the focus of the upcoming discussion.

The starting point for this analysis is the set of twelve assessment criteria used by Western Australia. Although there is overlap (as there would be in any such set), these twelve are arguably the most atomised, and are also topic-independent, thus rendering them particularly useful as a preliminary auditing device via two questions:

Is there substantial evidence that each of these aspects is also an aspect of assessment in the other regimes, even if expressed differently? ('Y' or 'N' in first iteration of Table MA1)

Is there substantial evidence that several of the other regimes have aspects of assessment not encompassed in some way by this set of 12 criteria? (If so, include in Table MA1 and repeat 1.)

Notes to accompany Table MA1:

The West Australian entries are the basis of comparison.

'N' does not guarantee that no assessment in this aspect occurs, only that we did not find anything explicit in the document(s).

Conversely, the fact that assessment in an aspect is valued in the document might not guarantee that this will happen for all students studying that course, especially if sampling and trade-offs are involved in setting papers and marking student work.

Instances exist of aspects that are explicitly valued by just one jurisdiction and hence are not included in the table. For example, South Australia has assessable aspects to do with working independently and working cooperatively, and Tasmania has one to do with planning and organisation.

In some jurisdictions (eg, New South Wales), statements of aspects and standards are different for different courses whereas in others (eg, Western Australia) they stay the same irrespective of which mathematics course is under discussion.

As foreshadowed, there are differences in the expression and organisation of the aspects of assessment Also, certain words are used, or could be used, with different meanings, the word 'conjecture' being a case in point where it could mean anything from 'a statement known to be proved' to 'a statement which could well be true, but might not be'.

For the purposes of this analysis:

- evaluation of the likelihood/worth of solutions is deemed to be evidence of *Verification*;
- even though graphing/sketching is a form of representation, *Representation* is treated as constituting non-graphical representation so that *Graphing/sketching*, which figures highly as an independent aspect in several jurisdictions, can be audited in its own right;
- evidence of modelling and/or of using mathematical symbolism, is deemed to be evidence also of *Representation*;
- evidence of generalising is deemed to be evidence of *Conjecture*;
- the aspect *Modelling* is treated as involving engagement in modelling as a process, not just in the sense of applying pure results in a real-life context.

Table MA1: Aspects of Mathematics assessed across Australia

As per *WA*	ACT	NSW	QLD	SA/NT	TAS	VIC	*WA*
Facts	Y	Y	Y	N	Y	Y	*Y*
Concepts	Y	Y	N	N	N	Y	*Y*
Relationships	N	Y	N	N	Y	Y	*Y*
Skills	Y	Y	Y	Y	Y	Y	*Y*
Uses	Y	Y	Y	Y	Y	Y	*Y*
Comprehension	N	Y	Y	Y	Y	N	*Y*
Representation	Y	Y	Y	N	Y	Y	*Y*
Conjecture	N	N	Y	Y	Y	N	*Y*
Deduction	Y	Y	Y	Y	Y	Y	*Y*
Application	Y	Y	Y	N	Y	Y	*Y*
Communication	Y	Y	Y	Y	Y	Y	*Y*
Verification	N	Y	N	N	N	Y	*Y*
Other							
Modelling	Y	N	Y	N	N	Y	*N*
Problem solving	Y	Y	Y	N	N	Y	*N*
Technology	Y	N	Y	Y	Y	Y	*N*
Graphing/Sketching	N	Y	N	N	Y	Y	*N*
Evaluation (ie, 'assessing the value of processes', not 'calculating')	N	Y	Y	N	Y	Y	*N*

It can be observed from Table MA1 that the assessment aspects made explicit in some jurisdictions form a more varied or comprehensive set than do those in others. For example, the stated aspects for South Australia are a subset of the stated aspects for Tasmania (expected standards not taken into account). Some aspects of performance being assessed are common to all jurisdictions.

Presumably mathematical 'Skills' and their associated 'Use', 'Deduction', and 'Communication' are viewed by all jurisdictions as a critical component of what constitutes high-level mathematical activity. The assessment aspects also reveal certain predilections of the various jurisdictions for certain types of mathematical activity. For example, New South Wales, which covers most aspects, does not appear to emphasise 'Technology' and the 'Modelling' that technology has made viable. South Australia has a strong focus on mathematical Skills and their Application.

The preceding observations are significant. They tell us about a process of comparing standards across jurisdictions that involves comparing high-level mathematics performances in each jurisdiction as measured by that same jurisdiction's yardsticks. They tell us that sometimes we would be comparing the same thing, sometimes we would be comparing different things, and sometimes we would be comparing things that go beyond what some other jurisdictions have assessed. An examination of supplementary documents such as examination papers and assessment reports provided no further indication of the aspects labelled 'N' in Table MA1 coming into play at the actual time that assessments were being carried out.

Comparability of achievement standards in Mathematics

It makes sense to go forward with the following aspects of performance for comparing achievement standards across the country: Skills, Use, Deduction, and Communication, as identified above. The analysis is restricted to inferring standards from information about assessment (rather than from curriculum content). The lack of explication by the ACT and Victoria, of what is demanded at the aspirational level, means that any comparisons involving these jurisdictions should, in particular, consider supplementary assessment information. Owing to lack of such information, further comparisons here will no longer involve the ACT.

Victoria and South Australia each use a combination of internal and external assessment, with only external examinations and examination reports being readily available. In each case, no explicit connection is made between the marks awarded for the various questions and the state's assessment aspects. Thus further comparisons of aspirational standards in specific aspects will no longer involve Victoria, and comparisons involving South Australia will rely solely on the Criteria for judging performance given earlier.

Comparisons involving Tasmania will also not make use of the supplementary information about the external examination, though for a different reason. The external examination restricts itself to assessing students' performances in Criteria 6–10, which are the topic-dependent criteria. The other, more generic, criteria, including those involving 'Skills' and 'Communication' are accounted for by internal assessment, where there is a lack of information. So, as with South Australia, and Queensland which has only internal; assessment, comparisons will rely on the standards descriptors from the respective syllabuses. New South Wales and Western Australia are no exception in this regard; in general, the examination reports do not tie questions back to the performance bands. It is worth noting that the 2005 Examiners' Report ascribes some difficulties to being 'in some part due to a change in emphasis of style of question asking candidates to show, prove or deduce a given result rather than merely finding some quantity', which can be interpreted as a deliberate shifting of emphasis from one aspect to another.

Not using supplementary information here does not imply that it cannot be of use. It simply means that research would need to focus on questions such as:

Are achievement 'standards' implicit in the relative difficulty of what the questions ask? And, if so, how would we judge the relative difficulties of what is being asked?

Are achievement 'standards', if not the performance aspects being assessed, affected by, or dependent on, how the questions are asked? And, if so, how would we judge this effect? (For example, in some jurisdictions students construct answers, whereas in others they select the correct answer from multiple-choice options. In some jurisdictions, students are generally expected to develop the various stages of a solution, whereas in others a schema for the solution is given with students having to fill in the details.)

Research of this kind requires other sources of information and methodologies not possible here.

Results of analysis of achievement standards in Mathematics

Table MA2 re-presents information from the analysis above. (It is acknowledged that the organisation and expression of the descriptors is a limiting factor.)

It is apparent from Table MA2 that there are some significant differences in standards, sometimes as a result of students being able to do 'more' and sometimes because they are expected to do it 'better', or with more sophistication. Some illustrative notable examples, one for each, are given below.

In 'Skills' and 'Use', Tasmania envisages that students will not just select and apply skills but adapt them to fit new situations. Mathematical activity involves active construction of techniques.

In ‘Deduction’ Queensland looks for insights into the relationships between assumptions and propositions, presumably inviting students to consider such things as how the statements might need to be modified if a certain assumption is removed, or the effects of alternative assumptions. This goes well beyond recognising logical correctness and proving statements.

In ‘Communication’, three jurisdictions recognise that the standard of communication demanded will depend on such things as audience, purpose and medium of communication, and the sophistication of what is being communicated. Students must acquire, select and draw on a variety of communication-related repertoires.

Table MA2: Standards descriptors for some states/territories in some assessment aspects

(This table spreads over two pages.)

	NSW	QLD	SA/NT	TAS	*WA*
3. SKILLS and 5. USE	Exhibits extensive knowledge and skills appropriate to the courses Maths and Maths Ext 1 [implicit in]. Synthesises mathematical techniques, results and ideas creatively across the courses Maths, Maths Ext 1 and Maths Ext 2 to solve problems.	The **overall quality** of a student's achievement across the full range within the contexts of application, technology and complexity, and across topics, **consistently demonstrates**: ○ accurate recall, selection and use of definitions, results and rules ○ appropriate selection and accurate and proficient use of procedures ○ effective transfer and application of mathematical procedures.	• mathematical skills and understandings (without electronic technology)	In familiar and unfamiliar settings, and without recourse to teacher guidance and supervision, a person can: ☆ consider, select, and **competently** use techniques to measure, calculate, and approximate, to connect ideas, support points of view, and underpin sensible predictions; ☐ identify changed conditions and adapt the use of mathematical skills and techniques to respond constructively and **fully** to major changes; ▲ evaluate effectiveness and appropriateness of selected and adapted mathematical techniques used in specific contexts; ○ demonstrate **command** of the use of mathematical skills and techniques in all aspects identified for attention in previous evaluations;	*Can demonstrate nearly all of the manipulative and computational skills* *Can use nearly all of the facts, skills, terminology and concepts in routine ways.*
9. DEDUCTION	Constructs proofs in an abstract setting	The **overall quality** of a student's achievement across the full range within each context **consistently demonstrates** ○ use of mathematical reasoning and proof to develop logical arguments in support of conclusions, results and/or propositions ○ recognition of the effects of assumptions used ○ evaluation of the validity of arguments	• the ability to prove conjectures	▲ use algebraic and logic skills to aid **(**)** mathematical proofs;	*Understands the nature and role of deductive reasoning and proof and reasons deductively*

11. COMMUNICATION	Communicates sophisticated mathematical ideas and relationships using the algebraic, diagrammatic and graphical techniques of mathematics, concise notation and clear logical argument	The **overall quality** of a student's achievement across the full range within each context **consistently demonstrates:** ○ accurate and appropriate use of mathematical terms and symbols ○ accurate and appropriate use of language ○ collection and organisation of information into various forms of presentation suitable for a given use or audience	• the organisation and presentation of material; • the communication of mathematical information	In familiar and unfamiliar settings, and without recourse to teacher guidance and supervision, a person can: ☆ consider, select and **competently** use *methods and styles to communicate ideas and information clearly, accurately, responsibly, precisely, and* ***comprehensively;*** ☐ identify changed conditions and adapt *communication* to respond constructively, **and fully** to major changes; ▲ evaluate effectiveness and appropriateness of selected and adapted *communication* in specific contexts; evaluations; ○ demonstrate **command of** *communication* in all aspects identified for attention in previous evaluations; • where appropriate**, facilitate the processes enabling** others *to communicate effectively.*	*Can communicate mathematical ideas and results*

English (including Literature)

Before a discussion of English achievement standards across Australia, it is necessary to revisit the mapping exercise for curriculum content in English (as described in Chapter 2).

Because of the different ways in which different English curriculum documents describe language, the mapping of curriculum content across the country for subject English required a device, other than topic, for describing subject matter to be studied. Text types to be studied provided an alternative device for mapping commonality in content and then for rating 'essentialness' of text types thus identified. Curriculum content was also analysed in terms of the skills, dispositions and attitudes mentioned in curriculum documents.

In statements of standards, the words used to refer to the objects that students study or produce are 'texts', 'subject matter', 'material', 'ideas', 'meanings', 'viewpoints', without further explication of content (type or purpose of text, purpose for communication, type of audience etc.).

Achievement standards in English

The two elements in assessment of English are:

1. knowledge, understanding and cognitive/linguistic/social processes (responding, communicating, evaluating);
2. descriptions of quality of performance or levels of proficiency.

Assessment programs for English emphasise processes such as understanding and constructing meaning; understanding and manipulating texts and contexts (including audience and purpose), demonstrating linguistic competence, being creative, and thinking critically.

Which texts? Most curriculum documents include lists of prescribed texts, and schools, teachers and students make choices from these. Decisions are made by individual teachers as to how to approach these texts, and how to foster the skills required by the syllabus objectives.

Assessment criteria for English

Despite the inevitable overlap in the interactions of process and text, the range of processes referred to in curriculum documents as criteria for assessment are isolated and summarised in the list below.

- Response to **texts** (understanding of meaning, plot, connections between ideas and issues).
- Ability to communicate information/construct texts: sustained/precise **control of language**, including:
  - text structure and organisation
  - cohesion (links between parts of texts)
  - sentence structure (range and accuracy)
  - vocabulary
  - spelling
  - punctuation.
- Effective delivery of **spoken language**.
- Ability to communicate information/construct texts: for different **purposes, audiences and contexts** (see later for elaboration of 'context'):
  - ability to express **ideas**
  - ability to justify **viewpoint,** with relevant, balanced argument and evidence
  - creativity and originality
  - critical thinking.

- Ability to research, select, evaluate, synthesise **material** (information, ideas, arguments, images):
  - use of references.
- Knowledge/understanding of texts in their **contexts**, which includes the role of the following in construction, expression and interpretation of meaning:
  - context (social, cultural, historical)
  - author (bias, values, beliefs, choices)
  - relationship (eg, power, distance) between producer and user of texts
  - genre/textual conventions.
- Ability to interpret/recognise implications of **examination question**.

Descriptors of aspirational standard for English

The expressions (qualifiers) most commonly used to describe student work at the highest standard in English are:

Clear	Sustained/fluent	Insightful
Critical	Extensive	Personal/expressive
Refined/sophisticated	Precise	Detailed/in great depth
Complex	Skilful	Broad (range)

The wording of any of the English curriculum documents can be interpreted as including critical literacy. For example, all assessment regimes in this country require students of English to understand texts in their contexts, and this is reflected in prescribed reading lists. Texts always have some kind of context, which requires some level of understanding. For example, students studying *Romeo and Juliet,* obviously written a long time ago and describing expectations and behaviours not considered normal social practice in Australia in 2006, need some kind of background to its setting and characters (and possibly other features of the play's context) in order to appreciate it.

No unambiguous definition of 'context' can be found. Context can, for example, refer to the social, cultural or historical milieu in which a text was produced; or to the values, beliefs, opinions and choices made by the author in writing the text; or to the relationship, real or imagined, between the author and reader. The almost limitless range of possible interpretations of 'context' is just one feature of English curricula/syllabuses. A teacher for whom critical literacy is an important part of understanding a text such as Sophocles' *Oedipus Rex* or the film *Breaker Morant* (both part of the list of 30 prescribed texts for the VCE in 2003) can find support in the curriculum documentation for making this a focus in the classroom. For another teacher, this may be irrelevant.

Descriptions of how internal assessment is to be managed within external assessment regimes are sometimes far from prescriptive, often just emphasising general aspects of English for attention such as different modules, the use of orals as well as written tests, and the relative weightings of assessment components, while task design is the responsibility of individual schools or teachers.

Outlier – English Extension (Literature)

It is rare to find an English subject where critical literacy is explicitly represented in the curriculum. The clearest example is the Queensland subject, English Extension (Literature), taken by a very small proportion of Year 12 students (1.3 per cent of OP-eligible students). Unusual amongst English courses in Australia is its unambiguous 'critical literacy' approach, manifest in its discourse of 'reading practices' and 'expanding notions of literature'. The language and content of this curriculum document are noticeably different from mainstream English courses in Queensland and elsewhere.

Critical approaches are explicitly represented in the assessment requirements of the subject as illustrated by the following task specifications.

Task 2 involves a written complex transformation and a spoken/signed defense. The complex transformation may be presented as a print, hypertext/hypermedia or multimodal text. The spoken defense should be of approximately 10 to 15 minutes duration, and should be the work of individual students …

Students accomplish this task through the following processes:

a. Read a text(s) using appropriate reading practices that help produce an invited reading (reading with the text.
b. Identify the range of discourses and ideologies that are promoted in the text, and consider any they might wish to challenge or oppose.
c. Consider what alternative or resistant reading they want their transformed text to invite.
d. Intervene in the form of a complex transformation to produce this new invited reading of the text. (Discursive shifts are brought about in part by changes to the structural and textual features of the base text.)
e. Justify, in the form of a separate, contextualised, spoken/signed defense, the discursive shifts made in reading the base text(s) that are then materialised in the written transformation.

Understanding/interpreting the demands of the question

A notable feature of some assessment regimes (eg, South Australia/Northern Territory and Victoria) is recognition of the ability to interpret the set (examination) question as a requirement for high-level performance.

> Well focused and sustained answer that demonstrates an excellent understanding of the meaning and intention of the set question.
>
> Precise and perceptive understanding of the meaning and intention of the set questions.
>
> Understands the implications of the topic and uses an appropriate strategy for dealing with it.

Choice and more choice

In Section 1 of the VCE English Written Examination, 2005, Section 1, Text Response, students are required to write *two* responses to prescribed texts they have studied. The examination paper lists the *thirty* prescribed texts. There is one task for each of those 30 set texts in Part 1, and a different task for each of the texts in Part 2. Students are not permitted to write on the same text in Parts 1 and 2.

Part 1 requires students to develop a sustained interpretative point of view about a text, supported by detailed analysis and reference to the text.

Here is the task for Text 9 (of 30), *Hamlet*.

> Fortinbras, Laertes and Hamlet all seek revenge but pursue it in very different ways. Discuss.

Part 2 requires a developed and sustained discussion that analyses the underlying social or cultural values embodied in a text.

Here is the task for Text 25 (of 30), *The Penguin Book of First World War Poetry.*

> *The Penguin Book of First World War Poetry* shows that in times of war people's belief in others is tested. Discuss.

The assessment criteria for text response are:

- detailed knowledge and understanding of the set text chosen, demonstrated appropriately in response to the task;
- development in the writing of a coherent and effective structure in response to the task;
- control of expressive and effective language appropriate to the task.

Then there is a task that requires students to analyse the use of language and present a point of view. The stimulus material is on the implications of the banning of mobile phones in schools.

> Part 1 Analysis of language use
>
> Complete the following task. In a coherently constructed piece of prose, analyse the ways in which language is used to present a point of view in both the principal's newsletter article and the parent's letter found on pages 14 and 15.

This is followed by a task that requires students to present a point of view. Students can choose from three options.

> Part 2 Presentation of a point of view.
>
> Complete one of the following tasks. Draw on the task material on pages 14 to 16 as you think appropriate.
>
> a. Your class has been asked to write an essay for the annual school essay competition on the topic: 'We all learn best from experience, not through following rules such as the new rule banning mobile phones'. Write the essay; OR
>
> b. The student newspaper has published a feature article entitled: 'School rules, such as the ban on mobile phones, do nothing to protect young people'. Write a letter to the student newspaper expressing your view on this issue; OR
>
> c. Students have been invited to contribute feature articles to the school web site on the topic: 'Rules, such as the ban on mobile phones, benefit everyone'. Write a feature article expressing your view in response to this topic.

How comparable are the demands on students in the Queensland English Extension course and the Victorian English course? Do they have anything at all in common?

Physics

The seven tables in Appendix 3 present information about the highest available grade (achievement standard) for each state/territory in turn. Some words are underlined although they do not appear so in the original documentation. The reasons for this underlining are discussed later in this section. Table PA1 summarises the information in Appendix 3.

Table PA1: Summary of assessment criteria for Physics across jurisdictions

Criterion	No. of jurisdictions
General cognitive process	
Remember	7
Understand	7
Apply	7
Analyse	7
Evaluate	7
Create	7
Science-specific skill	
Investigation design	7
Work practices – individual, team	3
Use of technologies	6
Science communication	7
Laboratory safety skills	7
Laboratory manipulative skills	7
Social/historical issue	
Physics, society and environment	7
Current issues in Physics	2
History of Physics	1
Content topic	
Newtonian mechanics	1
Electricity & Magnetism	1
Wave motion	1
Atomic & Nuclear Physics	1

How statements about (descriptions of) standards are expressed across jurisdictions

Across the eight jurisdictions the standards are assessed by teachers (either through school-based assessments or through external examination marking). For the purposes of this report, teachers in these situations are referred to as teacher–assessors. To help the teachers identify a student performance as meeting the standard required for the award of the highest available grade (however this grade might be expressed/codified), most curriculum/assessment authorities provide, for each subject on offer, statements to describe performance at the highest standard.

An analysis of the way standards for the highest available grade in Physics are expressed across the country reveals four aspects of language usage:

1. Use of superlatives: Adjectives such as very good, extensive, high level, advanced, insightful, detailed, fully, outstanding, broad, deep.
2. Use of completion terms: Adjectives/phrases such as accurate, correct, appropriate, competent, in command of, logical, concise, coherent, effective, valid.

3. Reference to quantity/degree for steps in a solution: Two-step problems, multi-stage problems, long sequence of tasks, range of perspectives.
4. Complexity within assessment item or examination question: Two unknowns, several abstract concepts, unfamiliar contexts.

Comparability of standards for highest achieving students in Physics across jurisdictions

The method used to compare standards for the award of the highest grade in Physics across the jurisdictions consisted of the following steps.

- Assessment instruments, usually the external examinations, were accessed where they were available on the websites of the jurisdictions.
- The test questions that related to the single topic 'Electricity & Magnetism' were identified.
- The marking schemes for these questions were accessed where possible.
- Solutions to the test questions were written out by a Physics teacher-educator who is also a Physicist and a curriculum/assessment expert.
- The number of steps in each solution and the complexity of each step were noted.
- The difficulty level of the set of test questions for Electricity & Magnetism was judged on the basis of the 'golden rule' — the experienced expert.
- Judgments across jurisdictions were compared and checked.

Table G1: Availability of data required for analysis

Assessment-related object	ACT	NSW	QLD	SA/NT	TAS	VIC	WA
Examination paper	See Note 1	✓	See Note 2	✓	✓	✓	See Note 3
Marking scheme		✓		NA	NA	NA	
Assessment task on electricity & magnetism		✓		✓	✓	✓	

Note 1: The ACT has school-based assessment.

Note 2: QLD has school-based assessment. QSA provided the project with assessment instruments drawn from the moderation process.

Note 3: WA's TEE papers were acquired for a fee.

Comparison of difficulty of set of items for Electricity & Magnetism

Judgments of difficulty were based on the presence of the following types of examination question: complex 4-step, complex 2-step, and simple recall. A tentative conclusion is that at least three jurisdictions set examination questions that require an equivalent high level of performance by the students who are awarded the highest possible grade. Some jurisdictions appear not to set examination questions that are sufficiently discriminating (ie, that allow high-performing students to demonstrate their achievement in the subject).

Chemistry

The seven tables in Appendix 4 present information about the highest available grade (achievement standard) for each state/territory in turn. Table CA1 summarises the information in Appendix 4. Anderson's revision of Bloom's Taxonomy provides the first part of the framework for analysing the level of intellectual demand for the specified content area.

Table CA1: Summary of assessment criteria for Chemistry across jurisdictions

Criterion	No. of jurisdictions
Intellectual demand	
Remember	7
Understand	7
Apply	7
Analyse	7
Evaluate	7
Create	7
Science process skills	
Investigation design skills	7
Skills to use technologies	6
Science communication skills	7
Laboratory safety skills	7
Laboratory manipulative skills	7
Social perspective	
Society and environment	7
Content topics	
Electrochemistry	1
Thermochemistry	1
Kinetics and Equilibrium	1
Organic/Inorganic Reactions	1
The Mole	1

An analysis of the way standards for the highest available grade in Chemistry are expressed across the country reveals four aspects of language usage in describing student performance:

1. Use of superlatives: Adjectives such as very good, extensive, high-level, advanced, detailed, outstanding;
2. Use of qualifiers about completion: Adjectives such as accurate, correct, appropriate, competent, logical, concise, coherent;
3. Steps in the solution: Two-step problems, multi-stage (3+ steps) problems
4. Complexity within test item: Two unknowns, several abstract concepts, unfamiliar contexts

Within certain constraints, it appears that similar language is used across Australia to describe the performance of the highest achieving students.

Comparability of standards for highest achieving students in Chemistry across jurisdictions

The approach used to compare standards across jurisdictions for the award of the highest available grade in Chemistry consisted of the following steps:

- External examinations were accessed where they were available on the websites.
- Questions that related to the single topic 'Electrochemistry' were identified.
- Marking schemes for these questions were accessed where possible.
- Solutions to the questions were composed.

The available data sources were the same for Chemistry as for Physics (see previous section).

Comparison of difficulty of set of items for Electrochemistry

Judgments of difficulty were based on the presence of the following types of examination question: complex 4-step, complex 2-step, and simple recall. Within the analytical framework used, it appears that at least three jurisdictions require similar standards as measured in recent external examination papers (2004 and 2005), and that at least two jurisdictions do not examine students at the same level as do the other jurisdictions.

Australian History

This section considers the skills that a successful student of Australian history would possess at the completion of Year 12, based on descriptions of the highest possible achievement standards in a subject called Australian History or a subject that contains Australian history.

Of the students who achieve the highest available grade across the country, collectively they would be able to demonstrate that they have developed the following skills of historical inquiry:

- Awareness of significant events/people.
- Understanding continuity and change, different interpretations of history, the role of values in history
- Dealing with evidence; solving historical problems.
- Analysing documents; comparing/contrasting/threading.
- Critical analysis; literacy.
- Oral communication (history context).
- Written communication (history context).
- Understanding historical concepts and issues.
- Understanding uses and contributions of history.

A high-achieving student from the ACT will have made 'discriminating use' of primary and/or secondary sources to support a point of view, or they will have developed an analysis of a point of view. The response (which may be written or oral) must have an historical perspective that is informed by investigation and interpretation. The high achieving student's response will be accurate and thorough. S/he will have detected any bias in the documents.

High-achieving students from New South Wales, in the external examination, will have written responses to three short answer questions concerning source material on World War I. They will have accurately located the context of the document and made deductions from the material relating it to appropriate events of World War I. Thus they will have applied their own knowledge of World War I to the sources provided and they will have assessed the given sources in terms of their usefulness, reliability and/or perspective.

The Queensland course outline for Senior Modern History uses the voice of a student to express what a high-achieving student would be able to do:

> Our earlier focus on primary sources has continued, but with some added aspects. I'm pretty good at evaluating sources for their relevance, reliability and representativeness, but focus also on more complex questions about the reliability of individual sources, and the adequacy of whatever collection of sources I'm using. More and more, I realise that developing an argument in history is more than just amassing lots of primary sources and deciding which case most of them support. I now appreciate the need to decide which sources carry more weight, and the importance of corroboration and conflict among sources. …. For much of this year, we've focused on secondary sources more than we did last year. In particular, we've studied conflicting and competing interpretations put forward by leading writers in their fields. We've explored the reasons for the differences, including the standpoints of the writers, and differences in the ways they've supported their claims with evidence.

A student from South Australia or the Northern Territory will have undertaken a critical analysis of primary and secondary sources in one part of the three part external examination. It is thus a substantial part of the examination.

A student from Tasmania will have analysed and evaluated information as a compulsory component of internally assessed course work.

A student from Victoria will have answered a compulsory question in the external examination that requires analysis of a given piece of information and the answering of a series of questions that require the student to relate the source accurately to its particular historical context.

Likewise, a student from Western Australia will have undertaken document studies that take up 50 per cent of the external examination (Section 1 and Section 2).

Thus a high-achieving student who has taken 'Australian History' in any of the jurisdictions would be able to critique sources, would be able to relate primary sources to a particular context, and would be aware that both primary and secondary sources will convey varying interpretations of specific events.

According to the documentation, high-achieving students of 'Australian History' will have developed skills in written communication and the use of historical conventions such as referencing. As a minimum, students will have completed an essay of approximately 1000 words—in some cases, twice that length. In terms of historical conventions, students will know, as a minimum, a system of referencing their work.

A high-achieving student in the ACT will have completed a 1000- to 1500-word essay 'at home' and a briefer one in class. S/he will have demonstrated accuracy, thoroughness, perspective, ability to hypothesise, synthesise, and construct arguments 'using conventions of historical representation'. S/he will have identified key elements of essential sources and have well organised ideas.

A high-achieving student in New South Wales will have answered two essay questions on the external examination, each worth 25 marks (50 per cent of the paper), one based on the national study and the other on a significant 20th Century personality. In addition, for school-based assessment, the student will have undertaken a substantial research report.

A high-achieving student in Queensland will have, amongst other tasks, produced a substantial written assignment. Various genres are permitted but the assignment must address a 'valid research question' and demonstrate that a range of historical resources has been used. The assignment will have a bibliography.

A high-achieving student in South Australia or the Northern Territory will have answered essay questions on the external examination and will also have completed, for school-based assessment, a substantial (2000-word) 'individual essay' that counts for 20 per cent of the overall result. The student will have demonstrated that s/he can use sources as evidence, develop a logical argument and use a consistent system of referencing.

The external examination in Tasmania requires extended responses, with three questions to be answered in three hours. These questions will be in essay format although the third question (Section C) could be in another genre, encouraging imaginative writing, such as a conversation between two people with opposing views on the topic or an interview with an 'expert'. It is also likely that the student will have written essays and research reports as part of school-based assessment, but details of these are not readily available.

In Victoria, a high-achieving student will have written a substantial essay on the external examination (worth 25 per cent of the exam marks). She or he will have applied relevant knowledge from a variety of sources, developed a sound argument and considered the contention offered from more than one perspective. As a component of school-based assessment the student will have completed a research report.

In Western Australia, the high-achieving student will also have answered essay questions under examination conditions. Two essays are required on the external examination (worth 50 per cent of the exam marks) and, for school-based assessment, students are to complete a research assignment worth 20 per cent of the overall marks.

There are at least four different ways of assigning grades (in particular, deciding the final grade for a senior student of Australian history). The following list shows four of the ways of assigning grades:

1. Setting numerical boundaries for grades.
2. Combination rules on pre-determined criteria.
3. Characterising a student's global achievement in a course in terms of exit criteria.
4. Properties or characteristics or qualities of a particular piece of work.

Each of these methods can be found to exist in at least one jurisdiction. The first method involves awarding grades according to predetermined numerical ranges, often on the basis of a policy decision in a particular jurisdiction. The second method involves the application of multiple criteria for judging student work and then applying rules for trading off poor performance on one criterion against good performance on another criterion to award the overall grade. The third method identifies the criteria that are to be the levers for making judgments but does not have any elaboration of standards associated with those criteria. The fourth method applies to assessment programs that are designed around large tasks.

This variety of approaches, together with the lack of prescription of subject matter described in Chapter 2, negates the equating of standards in Australian History across the country. Appendix 5 is a collation of information about the award of the highest available grade in Australian History in various states and territories.

Moderation

This examination of comparability of achievement standards requires an analysis of similarities and differences in the current arrangements for moderation.

Sometimes it is necessary to make the results of one test or set of assessment tasks comparable to those of another. Two such situations in this are:

- validating teacher judgments (in the case where school-based assessment is operating);
- putting results onto a common scale (in the case where it is necessary to combine results in different subjects).

There are at least five different approaches to linking results from different assessments (Linn, 1993). The approach taken depends on the purpose being served. Practices in Australia involve two[25] approaches:

1. social moderation
2. statistical moderation.

Across the eight education systems in Australia, examples can be found of matches between the abovementioned purposes and approaches (forms).

Table G2: Moderation practices in Australia

Purpose	Form	
	Social moderation	Statistical moderation
Validation	Y_1	Y_3
Scaling	N	Y_2

In social moderation, which is also called consensus moderation, auditing, and verification, performances on distinct assessments are graded using a common framework and interpreted in terms of a common standard (eg, the quality of student responses to assessment tasks in School A and School B are interpreted in terms of a single set of statewide standards).

One example of social moderation in action is the use of peer review—teachers attend meetings to ensure that statewide standards in a particular subject have been interpreted and applied consistently across schools. In this scenario, like the previous one, schools develop their own sets of tests and assessment tasks in reference to a common content framework (or syllabus). Marking of student work depends heavily on professional judgments of teachers and a system of checks and verification. In another, slightly difference scenario, teacher judgments are reviewed by a panel of their peers. Another variation is the 'visitation' model for auditing the application of standards. All of these variations match the form and purpose indicated by Y_1 in Table G2.

In statistical moderation, which is sometimes referred to as scaling or anchoring, comparisons are made between results provided by different sources (eg, different types of assessment) or between results in different subjects (eg, English, Mathematics and History).

One example of statistical moderation in action is the use of external examination results to scale internal assessments so that the latter occupy the same range on the measurement scale before combining internal and external assessments in a given subject for reporting/certification. This description of adjusting scores matches the form and purpose indicated by Y_3 in Table G2.

[25] Linn (1993) mentions three others: Equating, Calibration, and Prediction.

Another example of statistical moderation in action is the use of a standardised omnibus test to adjust for between-subject and/or between-school differences in internal assessments before combining results in different subjects for statewide ranking of overall achievement. This description of adjusting scores matches the form and purpose indicated by Y_2 in Table G2.

Calculation of rank orders for university selection purposes

For some jurisdictions the student's TER, which has various names across the country, does not appear on the Senior Certificate but on a separate document (such as the Tertiary Entrance Statement). The states/territories have different methods for compiling rank orders for university entrance, although the underpinning principles are similar.

The approach to university entrance in Australia is based[26] mainly on combining results attained by students in senior secondary school. Using success at the senior curriculum as a predictor of success at the tertiary level is not a universal practice. Alternatives include aptitude tests (not necessarily curriculum-based), lotteries, course-specific skills testing (eg, manual dexterity for example for entry to dentistry), interviews, portfolios, and paying full fees. Some places that do use secondary achievement for tertiary selection take the grade point average without accounting for differences in subject-population characteristics or in intrinsic difficulty of subjects.

Through scaling, students are neither advantaged nor disadvantaged by the combination of subjects studied. The common scale is provided by a measure that is common to all students. One technique is the use of external examinations as the yardstick against which the achievements of subject-groups can be compared. New South Wakes scales against 'other-subject results'; that is, the common measure for scaling results in one subject is taken to be students' performances in their other subjects. An iterative process (sometimes called inter-subject scaling) is used to ensure that the distribution of students' results in a particular subject is aligned with the distribution of those students' results in their other subjects). Another is to administer an anchor test to all students involved, thus providing a different yardstick. against which the achievement of each subject-group can be compared. Whether the common measure is the external examination or an anchor test, it is the teacher(s) of the subject in each school who determine the rank order of students within that particular group.

Standardised tests and scaling

There are three examples in Australia of using an anchor test for scaling: the ACT Scaling Test (AST), Victoria's General Achievement Test (GAT), and the Queensland Core Skills (QCS) Test. The process of scaling involves a linear transformation in which the scaling parameters (measures of location and spread) are derived directly from a common scaling test such as the AST, QCS or GAT. The 'equivalence model' sets the mean and standard deviation (or mean and mean difference) of each set of school assessments to that group's mean and standard deviation (or mean difference) on the common scaling test.

The ACT and Queensland are similar in that they are the only states/territories in which there are no external examinations. They are similar in that they both use social moderation for validating teacher judgments. They are similar in that they both use an omnibus test to produce the scaling parameters needed to 'iron out' differences between subject-groups and/or school-groups (both in the case of Queensland) by transforming the distribution of school assessments to match the distribution of test scores. The scores can then be combined. One difference between the ACT and Queensland is that Queensland records a student's individual test grade (A to E) on the Senior Certificate as well as using group scores for scaling purposes.

Victoria is similar to the ACT and Queensland in that it has a general achievement test (GAT) but it is different in that is has external examinations (as well as some school-based assessments). The GAT is

[26] Although there is an ever increasing multiplicity of pathways

used to scale school assessments before they are combined with examination scores for inclusion in the Tertiary Entrance Score. It has other functions as well; for example, to check the accuracy of examination marking—the examination is reassessed if there is a significant difference between a student's examination score and predicted score.

This short discussion cannot do justice to the subtle differences between states/territories in conceptualising and operationalising statistical and social moderation. Details can be found at the ACACA website http://www.acaca.org.au. Details of the content and construct of the AST, GAT and QCS can also be found at that website.

Table G3 summarise the history and uses of the three standardised tests. There is reference to ASAT (the former Australian Scholastic Aptitude Test) that was used by the ACT, Queensland and Western Australia as a scaling test in the late 1970s through the 1980s.

Table G3: Summary of history and use of standardised tests at Year 12

	AST	GAT	QCS
State/Territory	ACT	VIC	QLD
Name of test	ACT Scaling Test	General Achievement Test	Queensland Core Skills Test
Used ASAT before	Yes	No	Yes
When developed in present form	1992	1993	1991
Individual results reported	No	No[27]	Yes
Scaling device	Yes	Yes	Yes
Validation device	No	Yes	No

Table G4 summarises the application of techniques of social moderation and statistical moderation to senior assessment and certification across Australia.

Table G4: Applications of social and statistical moderation

Purpose	Form	Technique	Examples
Validating teacher judgments	Social	Panels; Teacher meetings	ACT, QLD, SA, TAS, WA
		Visitation	SA, WA
	Statistical	Using external examinations	NSW, SA, TAS, VIC, (WA)
		Using other measures	VIC (GAT)[28]
Putting results onto a common scale	Statistical	Using a standardised test	ACT (ACT Scaling Test) QLD (QCS Test)
		Using external examinations	VIC
		Using other measures	NSW (other subjects)

[27] Have been made available to schools
[28] This is a form of marker monitoring.

The previous discussion referred to some of the processes used to ensure comparability of standards *within* each of the eight states/territories. It would be an interesting exercise to compare standards *across* Australia, *between* the eight jurisdictions in one of the ways that Linn (1993) lists.

Perceived advantage of high-level option in Tertiary Entrance Rank

Specific objective #3 for this study, 'Identify any correlation between the level of the options available in the subjects in question and the Tertiary Entrance Rank, or equivalent, score awarded', can be re-expressed thus: Does the process of compiling a tertiary entrance rank (scaling) advantage students in any subject? Or, from student point of view: Do I stand a better chance of getting a high TER is I study certain options within a subject? Specifically, is it the case that TER calculation gives greater weight to some subjects (the higher-level options) than to others?

There is one important reason why it looks as if subject-groups are advantaged when in fact they are not: The groups of students taking different subjects are different. For example, in comparison with students who received the highest grade in the lowest-level TER mathematics subject in one state, students who received the highest grade in the highest-level TER mathematics subject were:

- more successful at the other subjects they took;
- more successful overall on a standardised test of generic skills;
- more successful at a statewide assessment in the form of a writing task.

These differences are not caused by a conspiracy to reward students who get the highest grade in any particular subject (especially when there are options at different levels for a given subject). For example, markers of statewide assessment of *writing* do not know whose writing they are marking, which schools the students attend, which subjects they take (high-level *mathematics* or other mathematics options). And nor do they know student results in those other subjects.

The differences are caused because students do not choose subjects randomly and, as a result, there are real differences in the achievement of students in different subject-groups. These differences are reflected in their TERs. A student's choice of subjects (or of an option with a subject area) does not, of itself, confer an automatic advantage—it is possible to be at the top of the tertiary entrance rank order no matter which subjects are studied. What is important is how well you do.

A student does not become more successful simply by choosing a subject with a greater proportion of academically high-achieving students. And the corollary is also true. The lower TERs obtained by some subject-groups of students are not caused simply by their choice of subjects. The differences between different subject-groups of students should make us ask: Why do academically high-achieving students choose particular options? (J. R. Allen, personal communication).

This is not to ignore some of the deep technical issues that accompany the scaling of scores—'problems' to do with students taking subjects with highly correlated results, with the notion of a general estimate of ability, with skewed distributions and so on. Tim Brown, Daryl Daley and George Cooney are but three of the statistical luminaries in Australia who have done research in this area since the aggregation of scores at the secondary–tertiary interface became necessary throughout Australia. Fairness and complexity go hand in hand as research into anomalies continues.

Conclusion

Across Australia, in all five subjects under investigation, there is a degree of consistency in what is looked for at the time students' achievements are assessed. In any given subject, states and territories tend to pay attention to the same kinds of achievements and features of student work (eg, a student's ability to 'use evidence to support a point of view').

In Chemistry and Physics, there is a high degree of consistency in the kinds of achievements and features of student work that are assessed in the senior school, consistent with the high degree of commonality in Chemistry and Physics curriculum content.

In Mathematics, despite the commonality of curriculum content in high-level courses, there are some significant differences in what is required to achieve the highest available grade in advanced mathematics. Some jurisdictions require students to demonstrate mastery of a broader range of mathematical content; some appear to require higher levels of mathematical sophistication.

In Australian History, the assessed features of student work reflect the contextual approach to the teaching of this subject across Australia, meaning that what tend to be valued and assessed are students' skills of historical inquiry and critical analysis.

In English (including Literature), although all assessment regimes require students to demonstrate an understanding of texts and the ability to generate texts, there is considerable choice across the country in what those texts can be. There is no consistent explication of what jurisdictions assess in the subject English, although common words are used to describe requirements of student work if it is to be awarded the highest available grade (eg, clear, critical, refined/sophisticated, complex, sustained/fluent, extensive, precise, skilful, insightful, detailed).

While it has been possible in most subjects to identify the kinds of achievements that states and territories value and assess (ie, *what* students are expected to be able to do), it has not been possible in this study to draw conclusions about relative performance expectations (ie, *how well* students are expected to do these things). For example, it has not been possible to judge whether an 'A' in Chemistry in Western Australia represents a higher or lower level of achievement than a 'VHA' in Chemistry in Queensland. Part of the reason for this is that the Australian states and territories use different terms to describe achievement expectations. Terms such as 'advanced', 'extensive' and 'outstanding' may have unambiguous meanings within particular jurisdictions, but these meanings are not shared across Australia. The comparison of state and territory achievement standards depends on an understanding of what is intended by statements such as 'demonstrates *advanced* use of the Newtonian model' in a particular jurisdiction. A comparison of achievement standards across Australia would require an analysis of the work that students must produce (including their responses to examination questions) to be awarded the highest available grade in each jurisdiction.

Chapter 5 – Conclusions: What is? What should be? What next?

Quo vadis?

This study has analysed and evaluated the curriculum content and achievement standards of five senior school subjects—English (including Literature), Mathematics, Chemistry, Physics and Australian History—in all Australian states and territories. Through its analysis of existing curriculum documents in the eight states and territories, the study provides a picture of what teachers are expected to teach and students to learn in these subjects across Australia. Through its analysis of achievement standards (and some limited analysis of assessment instruments) in all states and territories, the study identifies the knowledge, understandings and skills assessed in each subject in each jurisdiction.

The study found a high level of consistency in curriculum approaches and content in some subjects across Australia and, based on the judgments of selected subject experts, many examples of good practice. However, the five senior subjects differ considerably in the extent to which they specify clearly what students are expected to learn. There are also significant differences in the language used to describe student achievement in the various jurisdictions, confounding the direct comparison of standards of achievement.

On the basis of this study, we believe it would be desirable to:

1. identify for each subject a curriculum 'core' that clearly specifies what all students in Australia taking that subject are expected to learn; and
2. develop a set of achievement standards as a nationally consistent description of how well students are expected to learn the core in each subject.

The analyses of curriculum content and achievement standards undertaken in this study have the potential to inform these two activities.

Common intentions

In studying documents and products of all state and territory authorities responsible for the development of senior school curricula, we have been able to distil out a number of broad intentions that the authorities share. These include:

- excellence in procedures and products;
- diversity in curriculum offerings;
- flexibility in arrangements;

- equity of access to participation, engagement and achievement; and
- validity and reliability in assessment.

In an attempt to attend to all these (and other) challenges simultaneously, state and territory authorities have developed a range of innovative approaches and solutions, some of which may be among international best practices.

In all parts of Australia students are provided with a huge variety of subjects and subject options from which they are able to choose. These subjects are designed for students with different abilities, interests and post-school aspirations.

Existing procedures related to senior certification provide schools with very high levels of flexibility. Most jurisdictions have the capacity for rapid and varied delivery of curriculum offerings.

These features of senior certificates—diverse subject offerings and flexibility in arrangements—are designed to ensure that all students have meaningful and attractive options open to them in the final years of school, including students who are most at risk of disengaging from education or training.

Despite differences in the balance of external and internal assessments and different emphases on various assessment modes and techniques, all jurisdictions attempt to make valid assessments of student achievement in the final years of secondary school and to provide reliable student results.

Findings

Curriculum content: What is common?

This study shows that the degree of curriculum consistency varies from subject to subject across Australia.

Physics and Chemistry are subjects with a very high degree of national curriculum consistency. Each state and territory offers subjects called Physics and Chemistry, and an analysis of the curriculum in these subjects shows that at least 85 per cent of curriculum content—both subject matter and intended skills/understandings—is common to all eight jurisdictions.

In Mathematics, 27 different TER courses are offered across Australia. These courses are designed for different purposes and for students with different abilities and interests. Within these 27 courses, each state and territory offers a course that is identifiable as high-level mathematics. An analysis of these high-level mathematics curricula reveals a high degree of consistency across the eight jurisdictions. Approximately 90 per cent of the content of these high-level courses is common across states and territories.

Among more than twenty TER History courses on offer across Australia, only two are called ‘Australian History’. Eleven of the twenty courses contain some Australian history, and there are three courses in Aboriginal studies that also contain some Australian history. In these fourteen courses, the subject matter (topics) of Australian history is generally embedded in a thematic or contextual approach. This means that it is not possible to identify specific topics (eg, particular historical periods) that all students are required to study across the country. Nevertheless, there is a moderate degree of consistency in the topics (eg, Federation) that teachers can choose as contexts for the in-depth study of issues. Also, there is general agreement in all curriculum documents on the purposes of studying History at senior level, on the skills of historical inquiry that students are expected to develop, and on the approach to the study of History.

There are eighteen TER English courses on offer across Australia, not including courses in English as a Second Language (ESL). Four of these courses contain the word ‘Literature’ in their title. Commonality across states and territories can be found in the study of ‘text types’. State and territory curriculum documents mention a total of fourteen different text types (eg, Poetry), and most

jurisdictions require students to study some particular types of text. The study of novels and plays is required in all jurisdictions except Queensland, which suggests a balance across text types, but does not require the study of any one particular type.

Text types also provide a way of identifying where literature is contained in senior English curricula apart from designated 'Literature' courses. For example, in Victoria, the English course requires that students study at least four texts from a selection of 13 types that include Poetry, Literature in Translation, Shakespearean Drama and Contemporary Literature. There is a high degree of agreement in state and territory documents on the skills and understandings that senior English courses are intended to develop. These range from 'using correct spelling, punctuation and grammar' to 'making meaning through texts'.

What students are required to study in English in the states and territories is not expressed in terms of topics. In some English courses there are set texts, in others there are set categories of text, and in others there is open choice. There are no specific texts that all Australian students are required to study.

Curriculum content: What is essential?

As well as analysing what is currently taught across Australia in these five senior subjects, this project also sought opinions on what *should* be taught in these subjects from selected experts (teachers, teacher-educators, university discipline specialists, and community members). These experts were asked to review and rate the importance of current curriculum content and to identify other content that they considered important but missing from current curricula.

In Physics, almost all topics identified as 'essential' by the majority of reviewers are present in all state and territory curricula. The only exception is the topic Static Electricity & Electronics, which was judged essential by the majority of reviewers but is not included in all state/territory curricula.

In Chemistry, the same topics appear in almost all state and territory documents and almost all were considered essential by the majority of reviewers. Two exceptions are Analytical Techniques and Gases in the Atmosphere, which appear in only some curricula. Analytical Techniques was rated 'essential' by almost all reviewers. On the other hand, while all states and territories include in their Chemistry curricula the historical development of Atomic Theory, none of the reviewers considered this topic essential.

In Mathematics, a list was developed of all topics covered in senior mathematics courses, and reviewers were asked to rate how essential each topic was for inclusion in the highest-level mathematics course. Almost all mathematics topics judged 'essential' by the reviewers appear in almost all state and territory highest-level mathematics curricula. The exceptions are The Binomial Theorem, Logic Proof, and Sequences and Series, which most reviewers considered 'essential' but are mentioned in a minority of advanced courses. (It is possible that, in some states, advanced mathematics students are exposed to these topics in other, complementary, mathematics courses.) One topic—Application of Calculus to Conics—is mentioned in all advanced courses but was not considered essential by the majority of reviewers.

In Australian History, reviewers were less inclined than in Chemistry, Physics and Mathematics to identify specific topics as 'essential' for all students to study. There is no history topic that all reviewers considered essential to the senior curriculum. The topics considered most important are: The Nature and Impact of Immigration, Foreign Policy and Changing Relations, and The Social and Economic Impact of World War I. Reviewers were more inclined than for the other four subjects to identify additional topics that they believed students should study (eg, the Vietnam War and Protest).

In English, seven text types are mentioned in all state and territory documents as possible text types for student study. These seven text types also were considered by the reviewers to be the seven most essential text types for student study. Of these, Prose Fiction was judged most essential, followed by

Contemporary Literature. A majority of reviewers considered Poetry essential. The other four text types mentioned in the top seven are Australian author/content, Film, Poetry, Drama/Play (the last-mentioned category being separate from Shakespearean Drama), and Prose non-Fiction. Most reviewers rated Shakespearean Drama 'desirable' but not 'essential'. Only a minority of reviewers rated the study of multimedia texts 'essential'.

Many of the English skills/understandings rated 'essential' by the reviewers appear in all state and territory English curricula. Rated most essential was 'communicating in writing', followed by 'understanding the role of context in text', 'understanding values, ideas and beliefs', and 'making meaning through texts'. The majority of reviewers considered good control of spoken and written English to be a crucial component of English courses. Some expressed the view that the senior English curriculum is not the only or best place for attention to linguistic accuracy; some described these as skills that should be developed in the earlier years of school; and some considered further instruction in these skills in the senior secondary years to be impractical because of time constraints.

Achievement standards: Are they comparable?

This study also considered the standards of achievement expected of students in each state and territory as reflected in jurisdictions' descriptions of what students must do to be awarded the highest possible grade (eg, Band 6 in New South Wales, Very High Achievement in Queensland). This analysis included an inspection of readily available assessment materials (school-based and externally set).

Across Australia, in all five subjects, there is a degree of consistency in what is looked for when assessing students' achievements. In any given subject, states and territories tend to pay attention to the same kinds of achievements and features of student work (eg, a student's ability to 'use evidence to support a point of view').

In Chemistry and Physics, there is a high degree of consistency in the kinds of achievements and features of student work that are assessed in the senior school, consistent with the high degree of commonality in Chemistry and Physics curriculum content.

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not shared across Australia. The comparison of state and territory achievement standards depends on an understanding of what is intended by statements such as 'demonstrates *advanced* use of the Newtonian model' in a particular jurisdiction. A comparison of achievement standards across Australia would require an analysis of the work that students must produce (including their responses to examination questions) to be awarded the highest available grade in each jurisdiction.

A curriculum 'core'

As noted, we believe it is possible and desirable to establish a curriculum 'core', at least in some nominated senior school subjects. We envisage this core as subject matter (eg, topics, text types, big ideas and concepts) and skills (both subject-specific and generic) that all students taking a subject would be expected to learn, regardless of where they live in Australia. These mandatory areas of study could be expressed either in terms of exposure (experienced curriculum) or in terms of outcomes/results (assessed curriculum).

This study has shown that, in Physics, Chemistry and advanced Mathematics, there is already a very significant core of common curriculum content (both topics and skills) across Australia. The study also has shown that, for Australian history, there is a common core of inquiry skills that all students are expected to develop, whether as part of a subject called Australian History or as a component of another History subject. The study has not found a core of common content (either topics or skills) in senior English (including Literature). However, even in subjects with a significant core of common content, this study has been unable to draw conclusions about the depth to which students are expected to learn common topics and skills.

Successful articulation into post-school destinations requires that students also have opportunities to develop a variety of skills that are not subject-specific, but generic. These skills can be developed through required areas of study such as English and mathematics and through mandatory (core) components of other subjects.

It is important that the concepts of a curriculum 'core' are expressed in language that is clear and easy to understand. This is not to say that technical and specialist terms should be avoided: these are required for precise communication among teachers. A lack of clarity in curriculum documents sometimes arises from the attempt to be inclusive and positive. Curriculum documents should identify core content and standards in clear and precise language, even if the concepts (eg, in Atomic Theory) are not widely understood by the public.

From common to core

The curriculum 'core' in a subject should:

- identify central concepts and principles that every student should know;
- relate these central concepts to the world that students understand;
- ensure sustained engagement with the central concepts and principles in order to develop deep understanding;
- express central concepts in language that is familiar to students;
- be developed to minimise overlap or duplication of core content across subjects;
- require the development of factual (or declarative) knowledge. Students must learn facts, concepts and procedures and must be able to demonstrate and apply this knowledge (eg, to problems, performances); and
- respect domain-specific knowledge (ie, strike a balance between everyday relevance and application and more esoteric knowledge).

Generic skills

Statements of core curriculum content should not privilege generic skills over conventional knowledge categories. Given that one cannot just think, but must think about something, the integration of academic content with the teaching and learning of higher-order thinking skills is essential.

Descriptions of achievement standards also should not be written in the language of generic skills. Given that standards statements are often viewed, even used, as summary statements about required coverage, they should be written in the language of the domain (and its core content).

Consistent terminology

Consistent terminology should be used in describing the subject matters of the core curriculum for a subject, and that terminology should be immediately recognisable as belonging to that particular subject. An example of this is provided in Appendix 6 for Physics (the topics listed are not necessarily recommended for inclusion in the core curriculum – it is the flavour of simplicity and specificity that is being highlighted). Some jurisdictions already present information in this way in their syllabuses.

The advantage of this description of the Physics curriculum is that a student moving to this jurisdiction would immediately be able to answer the question: What subject matter am I supposed to cover? A teacher of Physics who is either new to the profession or has had the experience of teaching Physics in different geographical locations would immediately be able to answer the question: Does this particular Physics curriculum require facility with mathematics (algebra, calculus, vectors and so on)? That teacher would also realise that students are required to do problems that involve mathematical manipulation. S/he would not be able to tell whether or not practical activities are an important component of the Physics curriculum.

If the teacher happened to encounter a jurisdiction that had decided to teach Physics as a problem-based or context-based subject, they might have found it difficult to invent enough realistic problems and exercises directly relevant to a particular context. At least those students would be exposed to enough exercises and calculations to enable them to grasp fully the concepts involved as well as to develop (transportable) skills in formulating and carrying out the solution of problems.

The teacher would not yet be able to ascertain the *standards* that apply to judging the quality of student performance in this Physics course. Descriptions of standards (and illustrations with exemplars) would be necessary for that. Well-written standards descriptors for this course would not be difficult to compose given the level of specificity in the subject matter that is listed. The teacher would then also know what conceptual depth was required, what assessment modes were encouraged or allowed, if topics had to be taught sequentially or sequentially, as units or part of a ‘spiral’ curriculum, according to a traditional approach or a problem-based approach, and so on.

General requirements for consistent terminology appear in the boxed text below.

Objects for which a common language should be sought:

Terminology of curriculum

Terminology of assessment (including moderation)

Objects for which common symbols should be sought:

Codes for reporting on certificates

Objects for which care should be taken in word usage:

Epistemology

Differentiation

The prescribed content of subjects should be written up in a style that:

Is obviously the subject

Is a summary version

Australian history

We have reported an estimate of less than 50 per cent for the degree of consistency across the country in topics covered in Australian History and of more than 75 per cent for consistency in skills of historical inquiry. We have also reported some other areas of commonality: definitions of history and the underpinning philosophies or rationales for studying it indicate a considerable level of agreement across jurisdictions.

The fact that there is considerable agreement presents a conundrum: If there is an agreed position among those responsible for curriculum development across the country, is that sufficient justification for that view to prevail? For example, the lack of agreement about subject matter to be taught and the freedom of teachers to choose contexts mean that some students of History might never be exposed to the notion of Federation.

It could be argued that what is popularly understood as Australian history (eg, in the mass media) is not Australian History as it is understood in existing curriculum documents, but rather a set of facts and events that have defined Australia. A relevant question is whether the senior school is the place to be providing students with an appreciation of these facts and events, or whether key facts and events should be provided to all students during the compulsory years.

Curriculum development

Many people are involved in curriculum development in each of the jurisdictions. One of the reasons why the curriculum development cycle is so long is that it takes into account the nature of the subject itself, the needs of the individual student, and the requirements of society. The nature of a subject might change over time, the needs of one student are not the needs of another, and the requirements of society are not static.

It needs to be appreciated that curriculum authorities have to trade off what is needed/desired by the subject itself (as represented by the learned community), the individual student (as interpreted by others, not necessarily the student), society (as represented by the various stakeholders), and the nation (as articulated through government policy).

This leads us to ask if there is a way to deal with the quandary of deciding what all students taking a subject should be exposed to (core curriculum content) other than by committee and/or the consensus of stakeholders. In determining the 'what' of core curriculum should we set out (a) some principles and processes and/or (b) some empirical approaches? Appendix 7 outlines some empirical approaches that might be useful in identifying core curriculum content and setting national achievement standards.

Equity

An imperative in identifying a core of curriculum content is to ensure that it challenges students of all ability levels and backgrounds. This means that the core probably must be accessible at different levels to ensure that the highest-achieving students are challenged and the lowest-achieving students do not become disengaged. Teaching to the middle (eg, by stripping out intellectually imaginative and challenging work) does no favour either to high achievers or to marginalised students. Shakespeare's plays (for example) represent a significant piece of the literary canon for understanding contemporary problems encountered by high achievers and not-so-high achievers alike.

In some subjects, particularly English, there is a question as to whether teachers have been given too much choice about what to teach (ie, include or exclude). Where there is complete choice, perhaps one cannot be surprised if curriculum content degenerates into a lowest common (or populist) denominator.

Concluding comments

While there are important issues to be resolved in relation to curriculum content for subjects such as English (including Literature), Mathematics, Physics, Chemistry and Australian History, there is a bigger issue at stake.

How many students across Australia actually take an English option that emphasises or even includes a study of literature and in turn exposes them to the canon? How many students across Australia develop an understanding of scientific concepts important to making decisions about real-world issues such as nuclear energy, genetically modified foods, water conservation, salinity, climate change and stem-cell research? How many students across Australia study History of any kind at senior level? How many students take highest-level Mathematics? How well are Australian students being prepared to contribute to national economic prosperity and to take their place as informed and engaged citizens in the twenty-first century?

Media reports sometimes criticise systems, schools and teachers for not producing the educational outcomes most valued by parents, employers, universities and the wider community. But have schools and teachers been given clear and unambiguous signals about exactly what is valued? If not, clear statements of core curriculum content and nationwide standards should assist.

The challenge as we see it is to set clear statements of core curriculum content within which schools and teachers have flexibility in relation to teaching strategies and learning contexts. An additional challenge is to set clear achievement standards which allow for different methods of assessment, but which provide comparable student results.

We can envision a future in which senior curricula are independently developed and managed across the states and territories, but with greater clarity in the language and symbols used to describe aspects of curriculum and assessment; greater consistency in curriculum arrangements, including the identification of a core of common curriculum content in selected senior subjects; and clearly stated achievement standards which provide increased comparability of results on senior certificates.

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Appendices

1. Reviewers' comments, English and Mathematics

English

In English courses, like other courses, there is inevitable conflict between breadth and depth in curriculum coverage. For English this conflict is manifest most clearly as a tension between literature, accuracy of linguistic control (spelling, punctuation and grammar), and the types of communication students need to master (including written texts for the workplace and multimedia texts).

Accuracy of linguistic control: Using correct spelling, punctuation and grammar

Good control of spoken and written English is necessary for successful participation in Australian society, in social, occupational and educational contexts, and was considered a crucial component of English courses by the great majority of reviewers. Some reviewers, however, highlighted the assumption that basic control of spelling, grammar and expression has been developed during earlier school years, and further instruction in language accuracy may be impractical (because of lack of time), ineffective (because of the fear of alienating students), or too late (because habits may already be ingrained). Furthermore, because written and spoken communications are needed in all subject areas, there is a view that English curriculum is not the only or best place for attention to linguistic accuracy.

When asked to rate the importance of using correct spelling, punctuation and grammar, reviewers most commonly indicated this skill to be essential or desirable, but with numerous qualifying comments such as:

> *Essential*: Yes there should be explicit teaching (practitioner).
>
> *Essential*: I doubt if poor spelling can be much improved by formal education; but punctuation and grammar certainly can, and certainly should be (academic).
>
> *Essential*: Unfortunately there is little time in the existing curriculum to build in programs on this. The thinking seems to be that by the time students enter the senior years they have these skills sadly this is not the case (sic). Therefore, sentence construction, expression, spelling is (sic) often poor (practitioner).
>
> *Desirable*: Desirable insofar as it assists clear communication. There is however the issue of balance – too much focus on the mechanics can be deadening and detract from higher order thinking. Teachers should support their students on these issues at point of need (professional).
>
> *Desirable*: Correctness according to whom? SAE (Standard Australian English)? Functional grammar? Traditional (grammar)? An awareness of the uses and differences may be more useful (academic).
>
> *Essential*: This item (sic) should be using 'appropriate' spelling punctuation and grammar. Whilst applying Australian Standard English should be an essential skill for all students, it is important that students realise that other Englishes (eg, Aboriginal English) are also appropriate sometimes. Knowing when it is appropriate to use 'slang' and less grammatically correct (sic) forms and knowing how to 'code-switch' is as important as using 'correct' spelling, punctuation and grammar when the circumstances call for it (teacher-educator).

Literature

The type and amount of literature offered and required in jurisdictions around the country varies enormously.

Shakespeare's plays are considered to represent the pinnacle of literary achievement. For some, they therefore represent one part of the literary canon to which all students should be exposed. The only Year 12 students in Australia who are *required* to study Shakespearean drama are those in New South Wales who *elect* to do English (Advanced) (approximately 45 per cent all students awarded the HSC). Shakespearean drama, however, is represented as a *possible* text type in all other jurisdictions in at least one of the English subjects on offer. It is therefore impossible to know if any student in any state, territory or school has actually studied one or more of Shakespeare's plays—either by school policy or student choice. Reviewers most commonly rated Shakespearean drama as 'desirable' or (less commonly) 'possible', rather than 'essential'. Their comments make the point that

the way in which Shakespeare is taught is of fundamental importance, as well as the fact that his plays might prove too great a challenge for students of some backgrounds:

> *Desirable*: Highly desirable, but will be problematic for migrants or students of a lesser ability. The method of teaching is absolutely critical to its success and enjoyment (professional).
>
> *Desirable*: It should not be mandatory to study a Shakespeare play in Year 12 (practitioner).
>
> *Desirable*: Part of the richness of our 'European' culture' (teacher-educator/practitioner).
>
> *Essential*: Part of the canon (practitioner).
>
> *Essential*: As Shakespeare is seen as emblematic of a Western cultural heritage, students should be studying Shakespeare. It is my experience that most students want to study Shakespeare. But HOW it is taught becomes key. The emphasis should be on performance and questions of value and relevance into the twenty first century need to be considered in classrooms. I would hate to see unquestioning acceptance of a late nineteenth century understanding of Shakespeare as the only way he is taught (practitioner).
>
> *Desirable*: Shakespeare is appreciated by many students, however equally he can turn some students off. I find it easier to study if there is a good film available, or if students can attend a live performance (practitioner).
>
> *Desirable*: (but must be) taught as a play (teacher-educator).
>
> *Desirable*: Less able students not able to cope with a full Shakespeare (teacher-educator).

Poetry forms a mandatory category of text for study in New South Wales (both major English courses), South Australia (both major English courses) and Western Australia (English Literature). In all other jurisdictions it is represented as a possible text type in at least one of the English subjects on offer.

Approximately equal numbers of reviewers rated poetry as essential as desirable.

> *Essential*: as poetic language offers alternative view of the world and ourselves to the emphasis on rationality in other parts of schooling (practitioner).
>
> *Essential*: Poetic language is in evidence all around students – from popular culture to the canon; an essential element of human expression (academic).
>
> *Essential*: Undervalued by society, poetry is critical in students' learning about the richness of sound, image and texture of thought and language (professional).
>
> *Desirable*: More poetry should be taught in schools – would be good to be included as a more significant part of Year 12 (teacher-educator).

Written workplace texts

Written workplace texts occupy a utilitarian position, which some consider to be far removed from the critical demands of the study of literature. Consistent with the general philosophy or rationale offered by all jurisdictions for the study of English, many curriculum documents refer explicitly to communicating in workplace contexts. Writing for the workplace forms part of the range of specified (school-based) assessment tasks in jurisdictions that give primacy to external examinations.

For HSC English in New South Wales, the 'study of English involves exploring, responding to and composing texts in and for a range of personal, social, historical, cultural and workplace contexts. Included in the objectives for English (Advanced) is that students 'will develop knowledge and understanding of the purposes and effects of a range of textual forms in their personal, social, historical, cultural and workplace contexts.'

Students undertaking Vocational English in Western Australia are expected to 'use and produce a range of appropriate oral and written texts relevant to the workplace'.

In Victoria, the study of English is designed to enable students to 'extend competence in using standard Australian English for further study, the workplace, and their own needs and interests'. School-assessed coursework (written assessment tasks) includes 'a collection of two or more documents suited to a specific workplace context, purpose and audience, in forms such as a short report, memorandum, letter, e-mail message'.

One of the applications in the South Australian English Communications subject is workplace writing.

The ACT also prescribes workplace writing in its English course. 'Effective communication skills are essential to all workplaces. All courses based on the English Course Framework should enable students to meeting the demands of further study, the workplace, and student needs and interests'.

There was, however, less support amongst reviewers for such texts in English courses compared to most other components of English courses. 'Composing/producing written workplace texts' was possibly the category of skill least often indicated by reviewers as 'essential'; it was often rated 'desirable' or 'possible', and occasionally even 'not desirable'.

Reviewers' comments (almost all comments elaborating ratings of importance were provided by practitioners):

> *Desirable*: Better learnt in the workplace – more immediate (academic).
>
> *Possible*: Beyond key (generic) communicative competencies, English has no more responsibility to the workplace than any other subject. English is NOT Communication or Workplace Studies. It does, however, incorporate a significant emphasis on effective communication. Skills developed here could then be transferred by students in their study of workplace communication (e.g. in Career Studies) (practitioner).
>
> *Possible*: it depends on context re school and students (practitioner.)
>
> *Not desirable*: unnecessary in school course (practitioner).
>
> *Not desirable*: By learning critical thinking and developing articulate writing skills students will be able to write workplace texts when they are required to (practitioner).
>
> *No rating given*: I don't know what is meant by this (academic).

Media/multimedia texts

The issue is the extent to which this kind of communication is represented in our lives.

Curriculum documents refer to electronic texts, multimodal texts, multimedia texts, videos. Because of practical constraints, however, it becomes more difficult to assess ability to use and create such texts under commonly applied conditions. There was also some disagreement amongst reviewers concerning the importance of multimedia and electronic texts. This may be partly because there is as yet little consensus on the definition of the terms 'multimedia texts' and 'electronic texts'.

It may be that respondents recognise the practical difficulties of assessing understanding and ability to produce multimedia texts. This is suggested in responses that refer to their increasing prevalence in the way students obtain access to and communicate information.

Comments in response to 'Type of text for study: Media/multimedia' – most of the elaborating comments came from reviewers explaining why they rated these as 'Essential'; almost no comments were provided by those rating them 'Possible', perhaps because of lack of clarity, perhaps reflecting the lack of consensus on the definition:

> *Essential*: It is essential that English recognises the fact that these are increasingly prevalent modes of expression/text making. I find it hard to see them as 'text types' since they are used to produce many genres or text types (teacher-educator).
>
> *Essential*: Exceptionally important in terms of students' relationship with today's world. They need to understand the interaction of words and images (professional).
>
> *Essential*: The text forms of the twenty-first century (practitioner).
>
> *Essential*: Should include TV drama, TV and other advertising; TV news; TV current affairs; other TV program types; still images – eg, posters, photographs; print advertising (practitioner).
>
> *Essential*: Everyday media (texts) must be part of a coherent and balanced Year 12 English course (practitioner).
>
> *Desirable*: critical analysis (practitioner).
>
> *Desirable*: Particularly in terms of students making their own multimedia texts and critical literacy (teacher-educator).

Essential: This category mandatory for genuine and sustained critique of popular culture (practitioner).

Essential: Given the multiliteracies available now, visual literacy is a crucial element for examination in any modern curriculum (academic).

Possible: Too little time in the course for literature as it is. A separate subject? (practitioner).

And in rating the skill, Composing/producing multimedia texts, reviewers provided the following comments:

Essential: By actually writing newspaper articles or creating an advertisement, web page, for example, students learn to appreciate the rationale behind their construction -- particularly target audience and social context (practitioner).

Essential: Students need to spend as much time composing/producing as they do reading. Without working with language in a productive way, they can not develop the skills necessary for the wide range of adult working contexts (professional).

Desirable: Should become essential once schools and students are fully equipped (teacher-educator).

Desirable: It will be essential within 5 to 10 years I would think. Not the equipment or skills available to mandate it just yet (practitioner).

Possible: covered in other subject areas (practitioner).

Critical thinking/critical literacy

The wordings in curriculum documents and in reviewers' comments suggest that there is lack of clarity and consensus in interpretation of the meaning of terms, including the term 'critical'. It seems likely that the presence or absence of both 'critical thinking' and/or 'critical literacy' is implicit in all English curricula, depending on individual understandings and readings of curriculum documents. References in the assessment components of curriculum documents most relevant here include understanding of context (social, cultural, historical), author (bias, values, beliefs, choices, relationship with user/reader/viewer of text), and relationship between producers and users of texts.

The point is well illustrated by the following comment from one of the reviewers.

> The notion of Critical Thinking assumes that the criticism is according to some prior knowledge, experience, or opinion. You cannot just 'be critical'. Ideally an English course should introduce students to ways of exercising critical thinking which range from passing judgment on the ways in which texts appear to have (or have) been made or written (issues of technique and taste) to evaluation of the actual opinions, impressions, stated or implied, which they read in the text (the meaning they have made of them). It is a very long continuum. It would also include consideration of from where their own and others' critical standpoints might derive. In other words, criticism is for something.
>
> I am aware that the sources of these lists of skills are existing Year 12 curriculum documents. Perhaps nothing illustrates the differences between English teachers/courses/theorists in Australia (better) than the word 'critical'. [I am NOT talking about Critical Literacy]. In the discourses of English the word has many meanings, many of them vague. One that does not have much currency in English documents in Australia is a notion of 'critical' implied by the study of rhetoric and formal logic (The latter is notably absent in the critiques of Critical Literacy which have become common in our national daily newspapers) (teacher-educator).

Mathematics

Topic	Comments
Calculus: Differential	I regard calculus and the basic study of rates of change fundamental at this level. It has so many applications in other areas and so much connection to reality. / Needs a good theoretical introduction.
Calculus: Integral	As the inverse process it is important – and also its connections to other mathematical areas such as probability distributions / Needs a good theoretical introduction.
Calculus App'n: Rates of Change	Critical as this is the major aspect of calculus applications at this level.
Functions & Graphs	Fundamental / Students should be familiar with a range of functions including polynomial and trigonometric, using the power of technology such as graphics calculators to study properties of functions and to use functions as mathematical models. / The really important aspect here is that the students see the big picture of how functions and graphs are built and thus also use the algebra of function / To include exponentials, logs, polynomials.
Functions & Relations	Fundamental.
Functions: Algebra of Functions	Fundamental / I assume this is composition of functions and inverse functions. Composition of functions is essential for calculus. Inverse functions contribute to a broad picture of fields. / If this topic is about manipulation of algebraic symbols I do not believe it is desirable in today's mathematics courses and far prefer to see algebra as modelling by functions with use of Graphics calculators, CAS and computing packages / Once a student knows the basic functions and transformations, then adds the idea of addition, product and quotient of functions, they can visualise building the graph of nearly any function. Algebra of functions takes this further and makes the connections also to other areas of mathematics through the idea of algebraic systems /
Linear Equations	Systems of two equations should be prior knowledge. While studying systems in more than two equations provides a greater sense of completeness, the skills could be de-emphasised, particularly with the ready availability of graphics calculators that will handle matrices. And CAS-enabled calculators that will solve systems of equations symbolically. / This should have been done prior to Year 12 but systems of equations should be met.
Probability	As with all topic thought must go into the depth of treatment of this topic. / Difficult to give a sensible response without knowing anything about the actual content, depth and type of treatment etc / Good differentiator in a course Use of language. / Including pdfs / It really depends on what is meant by probability. If it is a formal look at probability distributions this may well be better left to tertiary studies. However all students should be introduced to the power of mathematics to solve stochastic problems. I question the importance of formal counting techniques. / Probability and statistics are really important for applications in many fields and basic understanding of them should be in all mathematics courses at a fairly simple level.
Calculus App'n: Diff'l Equations	Exposure is essential but treatment should be limited or be related to straight forward case only. / It is more important that students have a thorough understanding of the principles and conceptual underpinnings of calculus than solving differential equations. Comparison should be made of numerical methods and solutions using formal calculus. / SHM and exponential growth essential,

	others desirable / These could possibly be picked up at university without exposure at school.
Complex Numbers	Complex numbers provides a sense of completion to the number system. Could include some chaos theory. / I believe this is an area that is better suited by being left to tertiary level studies. / Interesting –could be left until uni, students do not see applications. / The obvious extension of the number system and also good connections and extensions to trig, binomial function among others.
Statistics	As with all topic thought must go into the depth of treatment of this topic. / Essential application to other disciplines /this topic has pushed too much Maths aside in our courses at present. / Very important to understand some of the basics
The Binomial Theorem	Has this been superseded by the availability of CAS? / Make links with probability distributions. / Provides a useful structure for expansion and has application in probability as well / Should only appear with respect to Binomial Probability – not as a stand alone
Vectors	include vector calculus / Systems and basis for many aspects of engineering and applications of mathematics / Vectors provide an alternative lens on geometry, and are especially valuable when looking at 3-D problems.
Logic – Proof	In what context would proof be taught? As a stand alone topic? As part of the study of other topics? / It is highly desirable that students are exposed to proofs before reaching university / Should focus on geometric proof using Euclidean and vector methods. / The idea of justification and proof is at the basis of much mathematics and students should develop basic ideas of justification and proof without it consuming the curriculum at this stage. / They should understand how to formulate a proof
Matrices	If studied, matrices should be closely linked to vectors and systems of linear equations. Although not essential as they can be introduced at University, matrices introduces a field with different properties to number systems, and hence gives students a more coherent view of mathematics. They provide a method for solving practical problems as well as systems of linear equations. / Matrices are used in Economics and many computer applications as well as in solution of systems of equations and geometry. They also, along with vectors, provide a vehicle for meeting different algebraic systems and illustrate non-commutativity and discussion of the existence of inverses.
Sequences and Series	Should include iterative sequences and some introduction to chaotic series, using technology. / Students need to be familiar with arithmetic and geometric sequences and series at least to ease into more advanced analysis at later stages / Students need to see non arithmetic and non geometric sequences as well to assist in the understanding of the classification and its use. / Usually done in Year 11
Logic – Induction	Exposure is essential but treatment should be limited or be related to straight forward case only. / Induction provides a powerful method for proving some interesting number properties (in particular), but could be left until tertiary studies. / One of the forms of proof but one that students do not easily understand at this stage. It is not as important as some other areas
Calculus App'n – Conics	I enjoy conics but they are not as relevant as some other areas of mathematics / I have rarely used this in 30 years / I suspect conic sections has traditionally been included because teachers enjoy it. In my experience students don't! / If this was included only as another reason to use calculus alone it should be excluded.

2. Assessment aspects and aspirational standards, highest-level Mathematics, all jurisdictions

ACT: Criteria and standards descriptors for the A-grade (highest of five)

Criterion	Knowledge	Application	Communication	Argument	Technology
Descriptor of A-grade	Demonstrates a very high level of recall of facts, techniques and formulae.	Selects, extends and applies appropriate modelling and problem solving techniques.	Is consistently accurate and appropriate in presentation of mathematical ideas in different contexts.	Uses mathematical reasoning to develop logical arguments in support of conclusions, results and/or decisions, justifies procedures.	Uses required technology appropriately and effectively.

New South Wales: Band E4 is the highest of four bands in the published draft performance bands.

Maths Extension 1: *The typical performance in this band:*

- Exhibits extensive knowledge and skills appropriate to the Mathematics and Mathematics Extension 1 courses;
- Synthesises mathematical techniques, results and ideas creatively across the Mathematics and Mathematics Extension 1courses to solve difficult problems;
- Uses sophisticated multi-step mathematical reasoning;
- Interprets, explains, justifies and evaluates solutions to problems;
- Translates efficiently between practical problems and their mathematical model;
- Communicates complex ideas and arguments effectively using appropriate mathematical language, notation, diagrams and graphs.

Maths Extension 2: *The typical performance in this band:*

- Exhibits mastery of most aspects of the Mathematics, Mathematics Extension 1 and Mathematics Extension 2 courses;
- Synthesises mathematical techniques, results, and ideas creatively across the Mathematics, Mathematics Extension 1 and Mathematics Extension 2 courses to solve problems;
- Combines excellent algebraic and modelling skills, multi-step logic and mathematical insight to solve difficult problems;
- Constructs proofs in an abstract setting;
- Communicates sophisticated mathematical ideas and relationships using the algebraic, diagrammatic and graphical techniques of mathematics, concise notation and clear logical argument.

Queensland: Minimum standards associated with exit criteria for Standard A (highest of five)

Criterion: Knowledge and procedures	Criterion: Modelling and problem solving	Criterion: Communication and justification
The overall quality of a student's achievement across the full range within the contexts of application, technology and complexity, and across topics, consistently demonstrates: • accurate recall, selection and use of definitions, results and rules; • appropriate use of technology; • appropriate selection and accurate and proficient use of procedures; • effective transfer and application of mathematical procedure.	The overall quality of a student's achievement across the full range within each context, and across topics generally demonstrates mathematical thinking which includes: • interpreting, clarifying and analysing a range of situations, identifying assumptions and variables; • selecting and using effective strategies • selecting appropriate procedures required to solve a wide range of problems;	The overall quality of a student's achievement across the full range within each context consistently demonstrates: • accurate and appropriate use of mathematical terms and symbols; • accurate and appropriate use of language; • collection and organisation of information into various forms of presentation suitable for a given use or

	• appropriate synthesis of procedures and strategies; …*and* in some contexts and topics. Demonstrates mathematical thinking which includes: • synthesis of procedures and strategies to solve problems; • initiative and insight in exploring the problem; • exploring strengths and limitations of models; • refining a model; • extending and generalising from solutions.	audience; • use of mathematical reasoning and proof to develop logical arguments in support of conclusions, results and/or propositions; • recognition of the effects of assumptions used; • evaluation of the validity of arguments, and justification of procedures.

South Australia: Criteria for judging performance

(NB: Syllabus gives assessment criteria not standards descriptors.)

The student's performance in the examination will be judged by the extent to which he or she demonstrates:
- mathematical skills and understandings (without electronic technology);
- mathematical skills and understandings (with electronic technology);
- analysis and interpretation of results and information;
- the communication of mathematical information;
- the ability to prove conjectures.

Tasmania: There are standards descriptors for 10 criteria, with the A standard (highest of three). Descriptors for the first five criteria (the generic ones) are given here.

# 1	Communicate ideas and information	In familiar and unfamiliar settings, and without recourse to teacher guidance and supervision, a person can: ☆ consider, select and competently use methods and styles to communicate ideas and information clearly, accurately, responsibly, precisely, and comprehensively; ☐ identify changed conditions and adapt *communication* to respond constructively, and fully to major changes; ▲ evaluate effectiveness and appropriateness of selected and adapted *communication* in specific contexts; evaluations; ○ demonstrate command of *communication* in all aspects identified for attention in previous evaluations; ● where appropriate, facilitate the processes enabling others *to communicate effectively*.
# 2	Plan, organise and complete activities	In familiar and unfamiliar settings, and without recourse to teacher guidance and supervision, a person can: ☆ set targets, consider, select and competently use strategies to achieve them, and capably and responsibly manage activities within proposed times; ☐ identify changed conditions and adapt plans and actions to respond constructively and fully to major changes; ▲ evaluate appropriateness of selected targets and the effectiveness of selected plans devised and adapted to complete activities in specific contexts; ☐ demonstrate command of planning and completion strategies in all aspects identified for attention in previous evaluations;

		● where appropriate, facilitate the processes enabling others to plan and complete activities.
# 3	Use mathematical skills and techniques	In familiar and unfamiliar settings, and without recourse to teacher guidance and supervision, a person can: ☆ consider, select, and competently use techniques to measure, calculate, and approximate, to connect ideas, support points of view, and underpin sensible predictions; ☐ identify changed conditions and adapt *the use of mathematical skills and techniques* to respond constructively and fully to major changes; ▲ evaluate effectiveness and appropriateness of selected and adapted *mathematical techniques used* in specific contexts; ☐ demonstrate command of the *use of mathematical skills and techniques* in all aspects identified for attention in previous evaluations; ● where appropriate, facilitate the processes enabling others *in the use of mathematical skills and ideas.*
# 4	Select and use technologies	In familiar and unfamiliar settings, and without recourse to teacher guidance and supervision, a person can: ☆ consider, select and competently use technologies to develop ideas and designs carefully, responsibly and imaginatively; ☐ identify changed conditions and adapt the selection and use of technologies to respond constructively and fully to major changes; ▲ evaluate effectiveness and appropriateness of selected and adapted technologies in specific contexts; ☐ demonstrate command of technologies in all aspects identified for attention in previous evaluations; ● where appropriate, facilitate the processes enabling others to select and use appropriate technologies.
# 5	Use algebraic manipulation techniques and associated symbolism in a variety of mathematical contexts	In familiar and unfamiliar settings, and without recourse to teacher guidance and supervision, a person can: ☆ interpret number and algebraic patterns in order to make (**) generalisations; ☐ use, interpret and generate appropriate symbols and terminology; ▲ use algebraic and logic skills to aid (**) mathematical proofs; ☐ apply formulae, theorems and mathematical techniques in order to simplify, evaluate and interpret expressions and solve equations; ● define, sketch and interpret appropriate functions and relations
# 6	Demonstrate an understanding of finite and infinite sequences and series	
# 7	Demonstrate an understanding of matrices and linear transformations	
# 8	Demonstrate an understanding of matrices and linear transformations	

# 9	Use techniques of integration and solve differential equations	
# 10	Demonstrate an understanding of complex numbers	

Victoria

The primary documents of the Victorian assessment regime do not provide grade descriptors. Instead, the syllabus lists three outcomes, together with the associated knowledges and related skills, and links these outcomes to **satisfactory** completion, but not highest-level achievement, via the statement: *The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit.*

Outcomes: For each unit the student is required to demonstrate achievement of three outcomes. As a set these outcomes encompass all of the areas of study for each unit. For each of Units 3 and 4 the outcomes apply to the content from the areas of study selected for that unit.

Outcome 1: On the completion of each unit the student should be able to define and explain key terms and concepts as specified in the content from the areas of study, and apply a range of related mathematical routines and procedures. It is expected that students will be able to use technology as applicable in the solution of problems, as well as apply routines and procedures by hand.

To achieve this outcome the student will draw on knowledge and related skills outlined in all the areas of study.

Key knowledge [includes]
- functions and relations, the form of their sketch graphs and their key features, including asymptotic behaviour;
- complex numbers, Cartesian and polar forms, operations and properties and representation in the complex plane;
- the geometric interpretation of vectors in the plane and of complex numbers in the complex plane;
- specification of regions in the complex plane using complex relations;
- techniques for finding derivatives of explicit and implicit functions, and the meaning of first and second derivatives of a function;
- techniques for finding anti-derivatives of functions, the relationship between the graph of a function and the graph of its anti-derivative functions, and graphical interpretation of definite integrals;
- analytical, graphical and numerical techniques for setting up and solving equations involving functions and relations;
- simple modelling contexts for setting up differential equations and associated solution techniques, including numerical approaches;
- the definition and properties of vectors, vector operations, the geometric representation of vectors and the geometric interpretation of linear dependence and independence;
- standard contexts for the application of vectors to the motion of a particle and to geometric problems;
- techniques for solving kinematics problems in one, two and three dimensions;
- Newton's laws of motion and related concepts.

Key skills [include the ability to]:
- sketch graphs and describe behaviour of specified functions and relations with and without the assistance of technology, clearly identifying their key features and using the concepts of first and second derivatives;
- perform operations on complex numbers expressed in Cartesian form or polar form and interpret them geometrically;
- represent regions of an Argand diagram using complex relations;
- apply implicit differentiation, by hand in simple cases;
- use analytic techniques to find derivatives and anti-derivatives by pattern recognition, and apply anti-derivatives to evaluate definite integrals;
- set up and evaluate definite integrals to calculate areas and volumes;
- set up and solve differential equations of specified forms;
- perform operations on vectors and interpret them geometrically;

- apply vectors to motion of a particle and to geometric problems;
- solve kinematics problems using a variety of techniques;
- set up and solve problems involving Newton's laws of motion;
- apply a range of analytical, graphical and numerical processes to obtain solutions (exact or
- approximate) to equations.

Outcome 2: On the completion of each unit the student should be able to apply mathematical processes, with an emphasis on general cases, in non-routine contexts, and analyse and discuss these applications of mathematics.

To achieve this outcome the student will draw on knowledge and related skills outlined in one or more areas of study.

Key knowledge [includes]:
- key mathematical content from one or more areas of study relating to a given application context;
- specific and general formulations of concepts used to derive results for analysis within a given application context;
- the role of examples, counter-examples and general cases in developing mathematical analysis;
- the role of proof in establishing a general result;
- the use of inferences from analysis to draw valid conclusions related to a given application context.

Key skills [include the ability to]:
- specify the relevance of key mathematical content from one or more areas of study to the
- investigation of various questions related to a given context;
- give mathematical formulations of specific and general cases used to derive results for analysis within a given application context;
- develop functions as possible models for data presented in graphical form and apply a variety of techniques to decide which function provides an appropriate model;
- use a variety of techniques to verify results;
- establish proofs for general case results;
- make inferences from analysis and use these to draw valid conclusions related to a given application context;
- communicate conclusions using both mathematical expression and everyday language, in particular in relation to a given application context.

Outcome 3: On completion of each unit the student should be able to select and appropriately use technology to develop mathematical ideas, produce results and carry out analysis in situations requiring problem-solving, modelling or investigative techniques or approaches. To achieve this outcome the student will draw on knowledge and related skills outlined in all the areas of study.

Key knowledge [includes]:
- exact and approximate specification of mathematical information such as numerical data, graphical forms and the solutions of equations produced by the use of technology;
- domain and range requirements for the technology-based specification of graphs of functions and relations;
- the relation between numerical, graphical and symbolic forms of information about functions and equations and the corresponding features of those functions or equations;
- the similarities and differences between formal mathematical expressions and their representation in various technology applications;
- the appropriate selection of a technology application in a variety of mathematical contexts.

Key skills [include the ability to]:
- distinguish between exact and approximate presentations of mathematical results produced by the use of technology, and interpret these results to a specified degree of accuracy;
- produce results using technology which identify examples or counter-examples for propositions;
- produce tables of values, families of graphs or collections of other results using technology which support general analysis in problem-solving, investigative or modelling contexts;
- use appropriate domain and range specifications which illustrate key features of graphs of functions and relations;
- identify the relation between numerical, graphical and symbolic forms of information about functions and equations and the corresponding features of those functions or equations;

- specify the similarities and differences between formal mathematical expressions and their representation in various technology applications;
- make appropriate selections for technology applications in a variety of mathematical contexts, and provide a rationale for these selections;
- relate the results from a particular application to the nature of a particular mathematical task (investigative, problem solving or modelling).

Western Australia: Grade descriptors for 12 criteria. *A* standard is highest of five

1. Facts	Can recall nearly all of the facts and terminology
2. Concepts	Can demonstrate the acquisition of nearly all of the concepts
3. Relationships	Can demonstrate understanding of nearly all of the relationships
4. Skills	Can demonstrate nearly all of the manipulative and computational skills
5. Use	Can use nearly all of the facts, skills, terminology and concepts in routine ways
6. Comprehension	Can understand given information
7. Representation	Can decide upon and use an appropriate form of representing mathematical data and relationships
8. Conjecture	Makes reasonable conjectures and attempts justification
9. Deduction	Understands the nature and role of deductive reasoning and proof and reasons deductively
10. Application	Can generally apply mathematical processes to routine and non-routine situations
11. Communication	Can communicate mathematical ideas and results
12. Verification	Can compare outcomes with expectations to verify the suitability and reasonableness of a result

3. Highest achievement standard in Physics, all jurisdictions

ACT: highest available grade is *A*

Criterion	Standards descriptor
1. Knowledge and understanding	Demonstrates broad knowledge and deep understanding of scientific concepts presented. Applies this knowledge to familiar and unfamiliar contexts, displaying originality and lateral thinking in problem solving.
2. Critical thinking	Describes patterns and trends in data observations and makes valid inferences. Discriminates between ideas by assessing the value of the scientific evidence presented.
3. Scientific investigations	Plans and performs scientific investigations with skill and initiative. Selects and uses appropriate resources and equipment efficiently and in a safe and correct manner. Displays an ability to collect data and assess its validity and accuracy.
4. Effective work practices	Organises time and resources to work in a productive manner independently and in a team environment. Facilitates effective outcomes in other team members.
5. Physics problem solving	Has initiative and can identify and solve complex problems.
6. Development of Physics models	Synthesises theoretical and practical information coherently.
7. Communication skills	Very high performance, Communicates complex concepts clearly.

New South Wales: highest available grade is *Band 6*

Criterion	Standards descriptor
1. Knowledge and understanding of concepts	Has extensive knowledge and understanding.
2. Description, explanation and application of Physics concepts	Displays outstanding ability to explain and clearly and accurately applies to novel situations.
3. Critical thinking skills in problem solving	Applies a high level of critical thinking to a long sequence of related tasks.
4. Data analysis, evaluation and extrapolation	Effectively analyses data, identifies complex relationships, quantifies and synthesises information to draw conclusions.
5. Communication of Physics ideas	Succinct, logical and sequential using a variety of formats.
6. Experimental design	High-level ability.

Queensland: highest available grade is *Very High Achievement (VHA)*

Criterion	Standards descriptor
1. Knowledge recall and application in simple situations	High ability
2. Scientific processes in simple Physics situations: collect data; process information; make simple judgments; communicate information, devise and design simple investigations	Very high ability to succeed
3. Complex reasoning processes in Physics situations, using understanding of Physics concepts and scientific processes	High ability in challenging situations
4. Manipulative skills in laboratory tasks	Satisfactory level

S**outh Australia/Northern Territory**: highest available grade is *A*

Criterion	Standards descriptor[29]
For Component 1: External examination	
1. Knowledge and Understanding: recognise, use, explain and interpret Physics	
2. Applications of Physics: to unfamiliar situations, to the design of experiments; to selected phenomena	
3. Analysis: identifies relevant data, describe patterns in results; critically analyse information	
4. Evaluation: of proposed solutions or experiments and draws valid conclusions	
5. Communication: identify and express ideas, correct use of terms, presents information in an organised and logical way, uses appropriate format.	
For Component 2: Course Work Same Criteria as for Component 1.	
For Component 3: Practical Work	
1. Experimental design skills	
2. Practical skills	
3. Presentation	
4. Interpretation and evaluation	
5. Communication	
For Component 4: Information Search & Oral Presentation	
1. Research skills	
2. Knowledge and understanding	
3. Communication	

Tasmania: highest available grade is *A*

Criterion	Standards descriptor
A. Internal Assessment	
1. Select and use technologies	Competently use; fully adapt; demonstrate command of technologies; facilitate processes enabling others to use technologies
2. Collect and categorise information	Competently collect & categorise; fully respond to major changes; demonstrate command of collecting; ; facilitate processes enabling others to collect
3. Plan, organise and complete activities	Competently manage; fully adapt; demonstrate command of planning; facilitate processes enabling others to plan and complete
4. Develop and evaluate experiments	Comprehensive understanding of design; adopt alternative methodologies where appropriate; clearly and rationally evaluate
5. Communicate ideas and information	Competently use methods and styles; fully adapt; demonstrate command of technologies; facilitate processes enabling others

[29] The fact that there are no entries in the right-hand column does not in any way indicate a deficiency in the system; merely another stark difference in arrangements across the country.

	to communicate effectively
6. Demonstrate knowledge and understanding of the impact of science on society and the environment	Logical and concise; clearly describe tensions and connections; demonstrate understanding and complexity from a range of perspectives
7. Demonstrate knowledge and understanding of Newtonian mechanics including gravitational fields	With Minimal teacher assistance; apply fundamental ideas; solve complex, multistage problems; make generalisations from data
8. Demonstrate knowledge and understanding of electricity and magnetism	Apply fundamental ideas; solve complex, multistage problems; make generalisations from data
9. Demonstrate knowledge and understanding of the general principles of wave motion	Apply fundamental ideas; solve complex, multistage problems; make generalisations from data
10. Demonstrate knowledge and understanding of particle nature of light and of atomic and nuclear physics	Apply fundamental ideas; solve complex, multistage problems; make generalisations from data

Victoria: highest available grade is A^+

Criterion	Standards descriptor
For school-based assessment	
• Use of Newtonian model	Demonstrates advanced use
• Description and explanation of Physics concepts	Correct physics terminology
• Application of concepts	Correct application to familiar and unfamiliar situations
• Analyse information	Uses several abstract concepts to explain complex relationships; make cause-effect judgments & offer explanations
• Safety awareness	Very high level of awareness
• Significant investigation	Demonstrates: advanced understanding; independently designs and conducts experiments; systematically collects data; accurate records; accurate, insightful and detailed observations; correct estimates of uncertainties; communicates valid conclusions of experiment
For external examination	Norm based: Top 20% receive A or A+
1. Description of data, concepts, models and assumptions in these contexts: motion; electronics; photonics; selected detailed study	Standard not applicable
2. Understanding of ideas underpinning technologies	Standard not applicable
3. Application of concepts and models to organise data and explain phenomena	Standard not applicable
4. Analysis of data to make conclusions and predictions	Standard not applicable
5. Evaluation of research problems, questions, conclusions and methods	Standard not applicable

Western Australia: highest available grade is A

Criterion	Standards descriptor
For school-managed assessment	
1. Knowledge	Extensive knowledge in all areas

2. Understanding	Very good understanding
3. Process skills	High level of proficiency
4. Problem solving	Solve two-step problems, and problems involving two unknowns
5. Communication of physical situations	Communicates understanding of physical situations
6. Experimental procedures	Accurate observations; specifies appropriate precision; appropriate records; high level skills with apparatus; confident and competent with procedures; recognises anomalous data; high level of critical analysis

4. Highest achievement standard in Chemistry, all jurisdictions

ACT: highest available grade is *A*

Criterion	Standards descriptor
1. Knowledge and understanding	Applies knowledge and understanding to familiar and unfamiliar contexts displaying originality and lateral thinking.
1. Critical thinking	Describes patterns and trends. Makes valid inferences. Discriminates between ideas.
1. Investigative skills	Plans and performs investigations within a team. Independently assesses the validity and accuracy of data
1. Communication of chemistry concepts	Communicates complex concepts clearly.

New South Wales: highest available grade is *Band 6*

Criterion	Standards descriptor
1. Knowledge and understanding of concepts	Has extensive knowledge and understanding.
1. Description, explanation and application of Chemistry concepts	Displays outstanding ability to explain and clearly and accurately applies to novel situations.
1. Critical thinking skills in problem solving	Applies a high level of critical thinking to a long sequence of related tasks.
1. Data analysis, evaluation and extrapolation	Effectively analyses data. Identifies complex relationships. Quantifies and synthesises information to draw conclusions.
1. Communication of Chemistry ideas	Succinctly, logically and sequentially communicates ideas using a variety of formats
1. Experimental design	High-level ability

Queensland: highest available grade is *Very High Achievement (VHA)*

Criterion	Standards descriptor
1. Knowledge recall and application in simple situations	High ability
1. Scientific processes in simple chemistry situations: collect data; process information; make simple judgments; communicate information, devise and design simple investigations	Very high ability to succeed
1. Complex reasoning processes in chemistry situations, using understanding of Chemistry concepts and scientific processes	High ability in challenging situations
1. Manipulative skills in laboratory tasks	Satisfactory level

South Australia/Northern Territory: highest available grade is *A*

Criterion	Standards descriptor[30]
Assessment Component 1: Examination	
1. Knowledge and understanding: Recognise, use, explain and interpret	

[30]The fact that there are no entries in the right-hand column does not in any way indicate a deficiency in the system; merely another stark difference in arrangements across the country.

Chemistry	
2. Applications of Chemistry to unfamiliar situations, to the design of experiments, and to selected phenomena	
3. Analysis :Identifies relevant data, describes patterns in results; critically analyses information	
4. Evaluation of proposed solutions or experiments and drawing of valid conclusions	
5. Communication: Identify and express ideas, correct use of terms, presents information in an organised and logical way, uses appropriate format.	
Assessment Component 2: Course Work	
Criteria 1–5 as for Assessment Component 1	
Assessment Component 3: Practical Work	
1. Experimental Design Skills	
2. Practical Skills	
3. Presentation	
4. Interpretation & Evaluation	
5. Communication	
Assessment Component 4: Information Search & Oral Presentation	
1. Research skills	
2. Knowledge and understanding	
3. Communication	

Tasmania: highest available grade is *A*

Criterion	Standards descriptor
A. Internal Assessment	
1. Select and use technologies	Demonstrate command of technologies; facilitate processes enabling others to use technologies
2. Collect and categorise information	Demonstrate command of collecting; facilitate processes enabling others to collect
3. Plan, organise and complete activities	Demonstrate command of planning; facilitate processes enabling others to plan and complete
4. Develop and evaluate experiments	Comprehensive understanding of design; adopt alternative methodologies where appropriate; clearly and rationally evaluate
5. Communicate ideas and information	Demonstrate command of technologies; facilitate processes enabling others to communicate effectively
6. Demonstrate knowledge and understanding of the impact of Science on society and environment	Clearly describe tensions and connections; demonstrate understanding and complexity from a range of perspectives
7. Demonstrate knowledge and understanding of the principles and theories of electrochemistry	Apply fundamental ideas; solve complex, multistage problems; make generalisations from data
8. Demonstrate knowledge and understanding of the principles and theories of thermochemistry, kinetics and equilibrium	Apply fundamental ideas; solve complex, multistage problems; make generalisations from data
9. Demonstrate knowledge and	Apply fundamental ideas; solve complex, multistage problems;

understanding of the properties and reactions of organic and inorganic matter	make generalisations from data
10. Apply logical processes to solve quantitative chemical problems	Apply fundamental ideas; solve complex, multistage problems; make generalisations from data

Victoria: highest available grade is A^+

Criterion	Standards descriptor
A. School-based	
1. Knowledge and application of experimental methods	Accurate measurement and recording of data
2. Analysis, interpretation and evaluation of experimental results and procedures	Processing of data into an appropriate form with suitable tables, graphs, charts, and/or diagrams; Recognition of unreliable or invalid observations or measurements; Accurate calculation to an appropriate number of significant figures; Recognition of trends or patterns; Relevant conclusions relating to the aim of the experiment; Valid explanations made for results, including unexpected results or errors; Suggestion of appropriate changes to experimental design and procedures where necessary.
3. Knowledge and application of terms, concepts and relationships related to chemical reactions	Accurate use of chemical terms and concepts to demonstrate understanding of qualitative observations; Accurate use of chemical terms, concepts and equations to demonstrate understanding of quantitative aspects of reactions; Understanding of the use of analytic laboratory procedures and instrumental methods in the analysis of consumer products; Accurate use of chemical symbols, SI units and terminology.
4. Analysis, interpretation and evaluation of experimental results and procedures	Processing of data into an appropriate form with suitable tables, graphs, charts, and/or diagrams; Recognition of unreliable or invalid observations or measurements; Accurate calculation to an appropriate number of significant figures; Recognition of trends or patterns; Relevant conclusions relating to the aim of the experiment.
5. Safety awareness	Appropriate application of safety procedures.
B. Examination	Norm-based: Top 20% receive A or A+
1. Recall facts, definitions, and examples.	Standard not applicable
2. Explain chemical concepts, principles and processes.	Standard not applicable
3. Apply understanding of concepts to unfamiliar situations and analyse	Standard not applicable

relationships.	
4. Analyse and evaluate experimental procedures; Analyse data to make conclusions and predictions.	Standard not applicable
5. Synthesise ideas.	Standard not applicable

Western Australia: highest available grade is *A*

Criterion	Standards descriptor
School Assessment	
1. Knowledge	Extensive knowledge and understanding in all areas
2. Understanding	Extensive knowledge and understanding in all areas
3. Process skills	High level of ability to explain or apply principles or theories in all areas
4. Problem solving	High level of ability to explain or apply principles or theories in all areas. Perform chemical calculations using the mole as a unifying concept
5. Communication	Communicates fluently using correct chemical terminology.
6. Experimental procedures	High knowledge and ability, working in a largely independent manner. High level of analysis and interpretation and able to design simple experiments.

5. Some information about highest available grade, Australian History

New South Wales

The highest achievement in New South Wales is Band 6. A student who achieves this will have received marks for internal and external components of assessment based on the following guidelines:

- Comprehensively analyses the key features of specific periods of twentieth-century history and evaluates the role of key individuals, groups, events and ideas;
- Evaluates the relative significance of factors contributing to change and continuity in the modern world;
- Displays a sophisticated understanding of historical terms and concepts;
- Utilises a variety of relevant historical sources and evaluates their reliability;
- Assesses different historical interpretations and perspectives;
- Communicates high-level argument through well structured and detailed texts.

Victoria

The highest classification of scores in Victoria is 41 or more out of 50 marks. To achieve this in Unit 4 school assessed course work, the student will have displayed the following:
Option 1

- Complex and sophisticated knowledge of the chosen crisis and response;
- Complex knowledge and analysis of the effects of the crisis and its impact on social cohesion;
- Thorough and relevant application of knowledge and use of concepts such as the ANZAC legend, The Depression, gender and identity;
- Critical analysis and evaluation of evidence that synthesises a range of written and visual sources to draw conclusions;
- Critical analysis of the way the crisis has been interpreted and understood over time;
- Very sophisticated use of historical conventions.

Option 2

- Comprehensive and thorough understanding of a range of attitudes evident in Australians' reactions to a significant social and political issue;
- Comprehensive evaluation of changes in Australians' reactions between two significant points in time;
- Thorough and relevant application of knowledge and use of concepts relevant to the chosen issue, such as politicisation, environmentalism, human rights, feminism, social justice, colonialism, multiculturalism, globalisation, republicanism and reconciliation.
- Critical analysis and evaluation of evidence that synthesises a range of written and visual sources;
- Critical analysis and evaluation of the way the experience of the period has been interpreted and understood over time;
- Very sophisticated use of historical conventions.

And, in the external examination, students who had 'excellent' papers (according to examiners):

- Displayed a very thorough knowledge and a well developed ability to explore issues and support ideas with relevant historical evidence.

The frequent use of words such as 'comprehensive', 'sophisticated', 'critical', evaluates', 'analyses' indicates some similarity in the expected standards.

ACT

The ACT course framework outlines the following qualities of a high achieving History student (A grade):

Student displays confidence, flexibility and initiative in selection and use of sources, showing insight and a critical awareness of alternative perspectives in resolving complex issues, and expressing a sophisticated grasp of content, values and cultures, communicating findings with clarity, vitality and imagination.
Although the assessment approach used is different from those in New South Wales and Victoria, the use of phrases such as 'critical awareness' suggests that there is some valuing of similar qualities in these jurisdictions.

Queensland, South Australia/Northern Territory, Tasmania and Western Australia

These jurisdictions outline criteria and describe what would be expected of a high-achieving student on completion of Year 12. In some cases (such as Queensland) these are explicitly described as exit criteria. The

way these criteria are described varies considerably. There are three broad criteria outlined in Queensland; ten in Tasmania. The extent to which there are similarities in broad criteria has been considered when seeking commonality in the curriculum area 'Australian History'. In an attempt to draw some conclusions about achievement standards across this heterogeneous array of descriptions, it is helpful to explore what is valued in broad areas of historical inquiry. We are focusing here only on those jurisdictions classified as having pre-determined exit criteria.

What is valued in the research process that would be followed by students undertaking a research report or extended investigation?

In **Queensland**:

- Identifying the issue for investigation;
- Devising, developing and focusing the key research question or hypothesis, and sub-questions;
- Locating and using primary and secondary sources;
- Maintaining a record of research;
- Reflecting on and changing direction or emphasis of research when necessary.

In **South Australia**:
(concerning hypotheses and focusing questions)

- Clearly identifies an aspect of history which has a specific focus

In **Tasmania**:
(influenced by generic competencies, with an emphasis on planning)

- Set targets, consider, select and appropriately use strategies to achieve them and competently and responsibly manage activities within proposed times;
- Adapt plans and actions to respond constructively and fully to major changes;
- Evaluate appropriateness of selected targets and plans, devised and adapted to complete activities in specific contexts;
- Demonstrate command of planning and completion strategies;
- Where appropriate, facilitate the processes enabling others to plans and complete activities.

This is also the case in **Western Australia**:

- Considerable planning and preparation evident
- Answers all parts of the question and directly/explicitly addresses all the required aspects
- Logical, coherent structure
- Clearly the student's own work − no evidence of plagiarism, correct use of reference/quotation conventions
- Provides a balanced and representative account
- Accomplished presentation skills
- Oral presentation is delivered without reference to notes
- Can respond fully to audience questions in an oral presentation.

What is valued in the gathering of historical information?

In **Queensland**:

- Identifying the information that is explicit in sources;
- Understanding the nature of historical sources of evidence, assumptions about the problematic character of historical sources, and the tentative and interpretive qualities of historical knowledge;
- Analysing what is explicit and implicit in sources, including themes, values and interrelationships within and among sources;
- Evaluating the worth of sources: assessing the reliability, authenticity, representativeness, relevance and accuracy of the sources and locating value positions, biases, perspectives and standpoints in their historical context;
- Making decisions about a question or hypothesis: synthesising evidence, reaching a conclusion about a question or hypothesis, and justifying the conclusion.

In **South Australia**:

- Appropriate use of primary and secondary sources to support reasoned historical argument

In **Tasmania**:

- Consider, select and competently use appropriate methods to collect and categorise specific, current and comprehensive information;
- Adapt use of collected information to respond constructively and fully to major changes;
- Evaluate effectiveness of selected information;
- Demonstrate command of collecting and categorising strategies;
- Where appropriate, direct others to collect and categorise information.

In **Western Australia**:

- Can set and manage complex tasks;
- Able to find and selectively use a wide variety of material;
- Critically reviews material;
- Interprets implicit meanings in both primary and secondary material;
- Recognises relationships between evidence on both explicit and implicit bases;
- Recognises the role of cultural contexts in shaping perceptions of the past;
- Evaluates the reliability of evidence by reference to context, motive and intention of the source/s;
- Able to draw conclusions and make judgments from information used;
- Excellent use of oral conventions;
- Able to interpret and analyse oral interviews.

What level of conceptual understanding is expected?

In **Queensland**:

- Identifying the information that is explicit in sources;
- Understanding the nature of historical sources of evidence, assumptions about the problematic character of historical sources, and the tentative and interpretive qualities of historical knowledge;
- Analysing what is explicit and implicit in sources, including themes, values and interrelationships within and among sources;
- Evaluating the worth of sources: assessing the reliability, authenticity, representativeness, relevance and accuracy of the sources and locating value positions, biases, perspectives and standpoints in their historical context;
- Making decisions about a question or hypothesis: synthesising evidence, reaching a conclusion about a question or hypothesis, and justifying the conclusion.

In **South Australia/Northern Territory**:

- Skills and concepts
- Recognises both subtle and obvious differences of interpretation among historians;
- Develops and debates clear and logical arguments;
- Evaluates, analyses, makes comparisons and contrasts;
- Communicates ideas and arguments in clear and effective speech and prose;
- Selects from historical materials on the basis of relevance;
- Discerns patterns in history;
- Uses historical information in depth and complexity;
- Interprets and applies relevant concepts.

In **Tasmania**:

- Explain relevant information in a logical way;
- Demonstrate through understanding a broad range of issues,
- Examine differing viewpoints and exhibit comprehensive understanding of the implications;
- Classify, categorise and organise detailed information from a wide range of diverse sources into logical patterns or points of view;

- Interpret complex ands subtle information relevant to an issue and attribute appropriate weight to it in opposing or affirming evidence.
- Accurately recall detailed historical information and apply it to support points of view;
- Detect prejudicial or fallacious information or argument that detracts from historical accuracy;
- Express historical information and ideas clearly and comprehensively.
- Examine the elements of historical debate and objectively present the range of points of view;
- Dissect the issues of historical argument, align them with historical context and trace the development of historical debate;
- Fully reflect on historical debate and comment on relative strengths of protagonists' points of view;
- Identify the terms of involved historical debate and cite complex points of view in a coherent manner.

In **Western Australia**:

- Accurate recall of the most abstract concepts the course presents;
- Sound analysis – detailed integration of knowledge, concepts and explanations;
- Able to critically analyse viewpoints, relate to values;
- Theories are distinguished from facts;
- Ability to solve problems, apply skills and knowledge to a range of situations;
- Demonstrates empathy with the experiences of others;
- Evaluates motives of groups and individuals;
- Possible limits of consistent performance: debate; appraise; hypothesise; modify; assemble; generalise; synthesise; judge; estimate; assess; rate; model; solve; interpret; evaluate.

6. Example of a statement of curriculum content (subject matter only)

Subject: Physics

Mechanics
- Concepts of displacement, velocity, acceleration
- Uniform-acceleration relationships ($v = u + at$ etc.)
- Concept of force, addition of forces
- Newton's laws of motion
- Weight and gravitational acceleration ($w = mg$)
- Newton's universal law of gravitation
- Rotational motion and centripetal force
- Kinetic energy ($KE = 1/2\ mv^2$)
- Potential energy, including gravitational potential energy ($GPE = mgh$)
- Work ($W = Fscos\theta$) and power
- Momentum and impulse
- Conservation laws of energy and momentum.
- Note: Use should be made of vectors wherever appropriate.

Waves and Optics
- Wave speed, wavelength, period and frequency ($c = f\lambda$, $f = 1/T$)
- Longitudinal and transverse waves
- Electromagnetic spectrum
- Reflection and refraction (Snell's law), change in wave direction and speed upon reflection and refraction at an interface
- Superposition of waves and interference
- Interference in thin films, diffraction due to a thin slit

Electricity and Magnetism
- Coulomb's law for point charges ($F = kq_1q_2/r^2$)
- Electric field and force ($F = Eq$)
- Potential and constant electric field ($V = Ed$)
- Electric Current and Ohm's Law ($V = iR$)
- DC electrical circuits
- Moving charge as source of magnetic field
- Magnetic flux ($\phi = BA\ \cos\theta$)
- Magnetic induction: Faraday's Law ($\varepsilon = \Delta\phi/\Delta t$), Lenz's Law
- Force on a moving charge ($F = Bqv\sin\theta$)
- Force on a current element ($F = Bil\sin\theta$)

Heat and Temperature
- Temperature scales and thermal expansion
- Heat, specific heat and latent heat ($Q = m\ C\ \Delta T;\ Q = mL$)
- Heat conduction, convection and radiation
- Kinetic Theory

Matter
- Bulk properties of materials: elasticity, strength, viscosity
- Atomic structure: Bohr model, subatomic particles (protons, neutrons, electrons)
- Electron energy levels and transitions, photons ($E = hf$)
- Radioactivity, including half-life
- Energy-mass equivalence ($E = mc^2$)

Source: www.mbc.qld.edu.au/physics/sp.html

7. Identification of core curriculum and achievement standards: Outline of a possible empirical approach

1. For mandated core content

- The method is hermeneutics (making of meaning, information coming in to researchers, being analysed and synthesised, going back out to readers, and repeating the spiral until agreement).
- Readers are teacher-educators, teachers, university discipline specialists, professionals from the wider community.
- Requires curriculum documents, synthesiser person, quantitative analyst, instructional writer, representative of each jurisdiction in attendance.

2. For nationwide achievement standards

- The method is pair-wise (paired) comparisons (David, 1987) of student work.
- Judges are teacher-educators, teachers, university discipline specialists, professionals from the wider community.
- Requires student work (in one easy-to-manage subject for a start, say Physics) from all states/territories, synthesiser person, quantitative analyst, instructional writer, representative of each jurisdiction in attendance.

Advantages of the empirical approach

- Seen to be objective
- Involves personnel from all jurisdictions
- Involves personnel from four categories (teacher, teacher-educator, university discipline specialist, professional from the wider community)
- In case of standards, involves primary evidence (student work) rather than words of intent (statements about standards)
- Not the traditional in-committee approach
- By-product might be a convergence to common terminology

Disadvantages

- Potentially expensive (because of number of people involved).
- Each activity is time-consuming (in terms of logistics).
- Might cause some uneasiness in some jurisdictions.
- Might yield unpalatable results (eg, that achievement standards cannot be compared across jurisdictions after all, or that the existence of different assessment regimes and methods confounds comparison, or that there are significant differences in standards across the country, which are exposed through this method).

Glossary

Terms used in this report were ascribed these meanings.

Achievement: Accomplishment of a particular body of knowledge and/or set of skills, usually after training or instruction. Not the same thing as ability (capacity) or aptitude (potential).

Achievement standard: See *Standard*.

Assessment (specific): The process of identifying, gathering and interpreting information about student learning.

Assessment instrument: Tool or device or constructed situation that has the primary aim of calling forth evidence about student achievement (eg, written assignment, oral presentation, performance, demonstration of mastery, practical work, field work, test, examination, project, viva voce).

Assessment technique: A method of gathering evidence about student achievement through observation, consultation and analysis of student work.

Attribute: Personal quality or disposition. Inclination to something (eg, tenacity, curiosity, justice).

Capability: Ability, power or fitness for some specified purpose or activity.

Capacity (ability): Current performance of a person in some defined domain of cognitive, mental or physical functioning. What that person can actually do, not what s/he might be able to do in future (aptitude).

Certificate: Official record, credential.

Comparability: The consistent application of standards so that student performances of equivalent standard are recognised as such. Comparability is reached when two or more sets of evidence of learning (emanating from the same curriculum intent) are reliably and validly judged to be of the same standard.

Competency: A 'life-performance' skill.

Conditions (examination or test conditions): See *Task parameters*.

Construct: Theoretical, intangible quality or trait, which allows for individual differences in that quality or trait to be measured.

Constructed-response: Refers to assessment items in which students are required to produce a short answer (as opposed to, for example, writing an essay, doing a project, or selecting the correct response from a list of options). Responses might involve writing a paragraph of exposition or explanation, performing a calculation, constructing a graph, compiling a table, producing a sketch or drawing.

Content standard: Description of what a student should know and be able to do (i.e. goals for individual student achievement) at a given point in time and/or under a given set of conditions.

Criteria (criterion, *sing*.): Those properties, dimensions or characteristics by which student performance is appraised.

Criteria-based: Refers to an assessment system whereby a student's achievement in an area of learning is interpreted in terms of pre-determined criteria and standards. Criteria-based assessment focuses on the specific nature of a student's actual achievements in relation to specific criteria (rather than to an established norm or relative to other students).

Criterion-referencing: The process of giving meaning to marks assigned to student work by referencing them to some specified behavioural criterion.

Cross-curricular: See *Cross-curriculum*.

Cross-curriculum (*n.* as *adj*.): As in transportable skills. See *Generic skill*.

Curriculum (as content): The selective traditions of knowledge and texts, skills and competences, processes and practices that education systems deem to be of value for construction by, and transmission to, successive generations of learners.

Curriculum (assessed): The pattern, style and emphasis on memory recall, understanding and modes of thinking that are prompted by the assessment items and tasks presented to students, and the marking rubrics used by teacher–assessors to reward specific performances;

Curriculum (developed): The curriculum frameworks and syllabuses, text book lists, work programs, schedules, time allocations, assessment programs, teaching strategies, and specified learning activities, all of which are developed to implement the intended curriculum.

Curriculum (enacted): The actual learning activities that take place in the classroom and the science laboratory, in the drama studio and on excursions, in sitting for examinations, doing projects, homework and so on;

Curriculum (experienced): The collection of students' learning experiences at school, including subjects taught and knowledge and skills acquired.

Curriculum (intended): The stated goals, purposes, philosophies, values, contexts, content for the curriculum, as articulated in syllabus documents prepared by curriculum authorities in response to government policy, and incorporating subject rationales, global aims, content objectives, assessment criteria and standards.
Curriculum (learnt): The actual learning that occurs in students—the internalised cognitive changes that are integrated meaningfully into memory, the forms of thinking that are attained, and the problem-solving skills, communication skills, and investigative skills that occur as a result of the student having experienced the enacted curriculum.
Curriculum (as process): The totality of the experience that the student has as a result of the provision made. The *pre-active* curriculum is what is planned to happen in national, state/territory, district, school or classroom arenas. The *interactive* curriculum is what actually happens.
Curriculum element: An identifiable, coherent activity specified by a syllabus (or other curriculum document) as relevant to the syllabus aims and objectives.
Curriculum intent: Mandated learnings, the official policy statement about what must be taught, including guidelines that teachers/schools must use in planning.
Curriculum organiser: In the general sense, any expression of a structure for the content of a curriculum (eg, eight Key Learning Areas).
Curriculum standard: Description of what should take place in a classroom (i.e. information that contributes to students reaching the goals set down in the content standards).
Disposition: Personal quality or attribute. Inclination to something (eg, tenacity, curiosity, justice).
Examination: Devised to assess the attainment and skill of students in a particular subject, whether by objective-type or by conventional written, oral or practical questions. All the questions refer to a syllabus that has been defined by a group of educators (teachers or examiners). In Australia, the term is reserved for external subject-specific assessment (as in the HSC in NSW).
Format (assessment/test format): The form/structure of arrangement/presentation of an assessment item/task to candidates (eg, multiple-choice, constructed response, extended written text).
Generic skill: A generalised ability or capacity developed over time from many and diverse experiences. Generic skills (cognitive and linguistic) are developed by students over time from a study of many and different domains, and are transferable to other [novel] areas and contexts.
Grade: Code representing the standard of student performance on an assessment task. Grades are denoted by various symbols, typically by consecutive letters, with *A* denoting the grade pertaining to the highest standard of performance. The lowest available grade identifies the threshold for acceptable performance. Often used to mean the single result for reporting (i.e. after aggregating results of several assessments).
Higher-order thinking: Logical, critical and creative manipulation of information and ideas—by combining them, going beyond them, transforming them, drawing conclusions from them, investigating what lies under them etc.
High-stakes assessment: Has two senses. One associated with the important consequences for the student (eg, being promoted or receiving a certificate): the other associated with consequences for instruction quality (eg, school rankings).
Knowledge (discipline-specific): The ways of knowing a particular discipline (or learning area); the possession of factual information, conceptual understandings and the ability to carry out procedures integral to that particular discipline (or learning area).
Learning outcomes: Descriptions contained in syllabus documents of the various skills and knowledge that students are typically to acquire as they become more proficient in a given learning area.
Mastery: Complete acquisition of knowledge (of a subject) or facility (in using an instrument or tool).
Medium: Means by which a student provides evidence of (or demonstrates) learning (eg, written text, dramatic presentation, computer interface). In some cases, student facility with the means itself might be assessable (eg, quality of written expression) whereas in others it might not (eg, writing down a calculation).
Mode (assessment/test mode): See *Format* (assessment/test format).
Moderation: A set of processes designed to achieve comparability across judges and across sites. Different forms of moderation serve different purposes.
Moderation (social): Validation of teacher judgments of the standard of student work by having those teachers' judgments reviewed by their peers, internally (within the same school) and/or externally (from a different school). Underpinned by descriptors of standards (explicit and *a priori*), evidence of learning (i.e. student work) that purports to meet the standard, and consensus amongst expert judges.
Moderation (statistical): Linking of results of different assessments by scaling to a common examination/test.

Moderation (visitation): Validation of teacher judgments of the standard of student work by having those teachers' judgments reviewed by moderators or subject assessment experts or district directors or personnel from a central agency.
Multi-disciplinary: See *Transdisciplinary*.
Norm referencing: The process of giving meaning to marks awarded to student work by referencing them to the performance of all students in that cohort. Main purpose is for ranking students.
Outcomes: See *Learning outcomes.*
Performance standards: Descriptions, via assessment tasks, of what it is that a student should know and be able to do and how well in order to demonstrate competence/achievement at that standard.
Portfolio: A deliberate, strategic and specific collection of student work upon which judgments about the quality of student achievement over a reporting period are based.
Reliability: The degree to which the results of assessment are consistent, dependable, or repeatable.
Report (as in *Report card*): Summary statement (in electronic or paper copy) that records an individual student's achievement (in whatever medium, genre or format) at a point in time and/or progress over time.
Reporting: The communication of information on the results of assessment of student achievement to a variety of audiences in a variety of styles for a variety of purposes.
Social moderation: See *Moderation (social).*
Standard (achievement standard)**:** Fixed point along the dimension/criterion representing/describing qualitative (and discernible) differences in student performance. Standards are the referents that underlie judgment of success or level of merit in a performance. The teacher-assessor judges which one of several designated standards best represents the characteristics of a student's performance; that is, what label to attach to the performance or what category (such as A–E) to place it in.
Standardised testing: Involves all, or a wide cross-section of, students across a jurisdiction (eg, State) of the same year or age sitting (versions of) the same test under the same conditions, and usually at the same time, with results being reported in a common format.
Standards descriptor: Statement or list of statements that succinctly conveys the required quality of, or features in, student work in order to be awarded the corresponding grade on a particular assessment task.
Standards-based assessment: Judging the quality of student performance with reference to pre-stated standards.
Standards referencing: The process of giving meaning to marks assigned to student work by referencing the image of the work to pre-determined standards of performance.
Statistical moderation: See *Moderation (statistical).*
Student work: The collection of the substantive products of student learning in and/or across curriculum areas, completed in response to assessable features of an assessment task. May include artefacts, performances, test responses, project work etc. It is the outward and visible sign (demonstration) of learning—evidence of achievement of one sort or another.
Task parameters: The set conditions for the production of evidence of student achievement (eg, working in solo or in teams, doing a task in paper or electronic format, completing a task over a prescribed period of time, via an oral interaction or demonstration).
Test: A published instrument constructed by persons technically trained in mental testing and statistical methods. Its items have been thoroughly tried out beforehand, and the test is accompanied by norms or standards of performance that enable the tester to interpret how far a student's score or mark is superior or inferior to those of other similar students.
Trade-off: The property of a judgment about the overall standard of student work that ensures that good performance on one criterion/feature can compensate for poorer performance on another; and that performance on several criteria/features contributes to the grade assigned to student work in a manner reflective of their hierarchical positions (weighting).
Transdisciplinary (as in transdisciplinary approach to teaching and learning): Drawing upon practices and skills across disciplines while retaining the integrity or each individual discipline's epistemology, methodology and canon. Similar to multi-disciplinary but not the same as the traditional interdisciplinary approach, which seeks links between disciplines often via thematic learning.
Transferable: Transportable from one context to another. It is assumed that the mastery of a skill in one context offers the potential to transfer to another, and that to master a skill within two different contexts is mutually reinforcing.
Validity: The degree to which an assessment instrument measures what it purports to measure. Validity is a multifaceted concept, traditionally defined in many different ways, each one emphasising one particular aspect and named accordingly (eg, construct, content, criterion, face, predictive).