International Comparisons in Senior Secondary Assessment

Full Report

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Contents

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A list of panel members including, where applicable, the organisations they represent appears at the Appendix.

Executive summary

This report presents the findings of a study investigating the demand of assessments commonly taken by students looking to enter higher education in other high-performing education systems in comparison with the A level qualifications in England. The aim of the project was to gain a detailed understanding and to judge the comparative demand of a range of subjects offered at senior secondary level in different parts of the world. This would enable us to reflect on how the system in England might develop.

What is assessed in examinations and qualifications, and the assessment techniques used to test students, are critical parts of any education system. They are particularly important for the highest achievers looking to progress to the most competitive higher education institutions and into the world of work.

We looked in detail at four subjects, representing different academic disciplines: mathematics, chemistry, English (where this is the national language or the main language of tuition) and history. Each subject included formed a part of the main qualification undertaken by students to gain entry to higher education in a range of education systems from Europe, North America, East Asia and Australasia, as well as some qualifications offered internationally. These were reviewed alongside one of the A levels offered in each subject in England. We reviewed both curriculum materials and assessment materials and focused on how these materials would enable the highest achieving students to demonstrate their abilities.

That the examinations and qualifications included in this study were those taken by students in preparation for higher education was one of the few common features identified. Some were assessments (provided either by the state or by another organisation) with the *specific purpose* of selecting students for higher education (for example a matriculation examination) while others were assessments of educational achievement that *in addition* are used to identify students for higher education (of which A levels is one). Further, some assessments were taken as part of a diploma or baccalaureate-style qualification with one or more compulsory components, while other assessments stood alone.

Because we have concentrated on individual subjects and not the whole curriculum on offer at senior secondary level, subjects within A levels start with an advantage when judging comparative demand. The small number of subjects typically taken at A level allows each to be the main focus of a student's study. Elsewhere, courses normally comprise much broader offerings, a core of compulsory subjects supplemented with a number of subject specialisms. This emphasis on the study of a broader range of disciplines may naturally limit the breadth and depth of study achievable in each individual subject.

Given this, it is maybe not surprising that through this detailed analysis in terms of depth and breadth of subject coverage and by affording students the opportunity to develop and demonstrate analytical skills, A level assessments compared favourably with other systems.

By subject area, the key findings are:

Mathematics

Mathematics qualifications worldwide offer a different balance between breadth of application and the pursuit of complex and deep study. Either style may result in a highly demanding qualification; however a broader range allows a student greater flexibility in the pathways that they can study in higher education.
A levels offer one of the broadest programmes of study seen. A level Further Mathematics was the broadest and deepest qualification reviewed. Its inclusion of abstract and technically difficult mathematics also makes it extremely demanding. All the qualifications reviewed in this project require the study of pure mathematics. The number of and depth of the topics covered affects the demand of the qualification, with demand reduced where significant study of calculus and trigonometry are not required. A levels cover both pure mathematics and the application of mathematics in the same course as well as including the study of mechanics. This is unusual, with few other systems covering mechanics within their qualifications. Additionally, other systems typically offer a variety of different mathematics assessments (often at a lower level). Several qualifications involve internal assessment. This could potentially broaden a qualification, allowing assessment of the application of IT, extended problem-solving and the use of mathematics as a modelling tool.

Chemistry

A levels have the most coverage in terms of breadth and depth of chemical knowledge, with content from organic, physical, inorganic and analytical chemistry being studied in similar proportions. Students taking the A level would therefore recognise the content of all of the qualifications included in this study. The A level has the most mathematical content of all chemistry subjects considered in the review and also includes a number of modern methods of analysis. There are different balances in different systems between theory, practice and application both within the syllabuses and assessments. This is linked to the purpose and rationale of the qualification. There are also distinct differences in how practical work is assessed and rewarded. The A level does have a strong emphasis on practical skills, however, in some other systems this is even greater with testing of practical skills making up a high proportion of the assessment materials.

English

This study found there to be no single unified definition of English as an academic subject. A levels are unusual in comparison with other systems in having an almost exclusive focus on reading and interpreting traditional forms of text. In other systems there is more of an emphasis on language and broader communication skills, or a combination of languages and literature. In different systems, there are very different views on what can be considered a text. Some take a much more multimedia approach with photographs and film appearing with some regularity. The structure and schemes of assessment also show considerable variation by system. The majority of qualifications offer a combination of written examinations and internal assessment. However, some use different approaches to the more conventional essay-writing, including short answer and multiple-choice questions, as well as oral examinations. The courses which provide the best foundation for study at a UK university include a focus on genre based study over single text study, testing of both content and skills, and where components are organised according to a coherent set of theoretical principles.

History

The A level offers considerations of conceptual understanding, effective deployment of knowledge, essay and document-based skills, and historical enquiry, often to a greater level than the other qualifications reviewed. A levels demonstrate a good balance of historical content with the concepts and skills to analyse and interpret materials. The inclusion of coursework and personal study (specifically related to historical studies) in A levels is also a strength, allowing the development and assessment of historical enquiry skills. The purpose of the history qualifications in other systems varies considerably. This clearly determines the extent to which students are required to study their own national history or develop a broad world view. The link between history and citizenship is emphasised in many of the systems studied, whether this is citizenship of a nation or of the world. Most qualifications reviewed rely on written assessment or examinations with the essay question the most consistently used question style, followed by the source question. The demand of these questions varies by qualification, with A levels including some of the most demanding questions seen. However, several other systems also rely heavily on multiple-choice questions or use oral assessment.

A series of themes emerged through the research. Some of these related to the subject specific findings outlined above, and others related to cross-cutting issues or wider structural considerations. These have been framed as issues that could form the basis for discussion around what should be prioritised in England as part of any future development of our senior secondary qualifications. These issues are addressed in detail in section 8 of this report but in summary are:

Issue 1: Breadth versus depth – Many systems have a baccalaureate- or diploma-style assessment system including the study of a number of subject areas that are not required as part of A levels. Would this additional breadth outweigh the strengths of additional depth of the current A level system?

Issue 2: Independent study – Would the inclusion of independent research, projects and extended essays bring additional depth to subject expertise?

Issue 3: Different levels of demand within mathematics – The number of different mathematics assessments at a variety of levels available to students in many education systems was also in contrast to A level Mathematics. Is there a need for A level Mathematics to have further lower-level options in addition to AS?

Issue 4: Breadth versus depth within mathematics – Within the more challenging mathematics courses considered, A level Mathematics is unusual in covering both pure mathematics and the application of mathematics in the same course. While this means that more fields within mathematics are available to study, other education systems include more demanding mathematics which an A level student can only access through additional A level courses. Would a more focused A level mathematics course better serve the needs of more capable mathematicians?

Issue 5: Specialism within mathematics - A level Mathematics includes optional routes. This means students with the same grade in the qualification may not be equally well prepared for a specific further course of study. Would distinct qualifications, building on a mathematical core but emphasising the different specialisms, better serve students and those seeking to match them to appropriate further opportunities?

Issue 6: Mathematical content in chemistry – A strength of A level Chemistry was seen to be its high mathematical content in comparison with other systems. Is this balance correct? Would students and higher educationalists find it preferable to have further or deeper chemistry content within chemistry and move the bulk of mathematics currently covered in chemistry to mathematics subjects?

Issue 7: Focus of the study of English − A levels were found to be distinctly different from the study of English in other education systems as they have an exclusive focus on reading and interpreting traditional forms of text. In other systems there is a broad range of views on what could be considered a text (from a photograph, to film, to Chaucer). Would a broader approach prepare students better for studying in a higher education setting?

Issue 8: Purpose behind studying history − Other systems often had a clear rationale for the study of history at senior secondary level, for example to promote good citizenship. Do we need to address a purpose for the study of A level History beyond preparing students for higher-level historical study?

Issue 9: School-based assessment – Should there be more teacher- and school-based assessment with the potential to stretch students, especially where oral examinations are part of the system?

Issue 10: Multiple choice – Multiple-choice questions are common in other education systems at senior secondary level. They are not common in A levels. Multiple-choice questions can be used to test large amounts of content and assess skills such as the ability to use the English language. These can be difficult to test by other means. Should we revisit the use of multiple-choice questions in A level assessments?

1 Introduction and methodology

1.1 Background

As the regulator of qualifications, examinations and assessments in England, and of vocational qualifications in Northern Ireland, we have a responsibility to ensure the qualifications we regulate are fit for their purpose: they are of a high quality, they command confidence, they equip students for the next step in their education or working lives and they are value for money.

In an age when students cross international boundaries to study it is also increasingly important the qualifications we regulate are comparable with those studied by students in other high-performing education systems[1]. Students in England will often be competing with international students for higher education and employment opportunities.

The current UK government asked us to monitor the standards of regulated qualifications in England against those available internationally. In response, we began a long-term rolling research programme to investigate the comparability of assessments taken by students internationally against those taken by students in England.

The first of these studies is the International Comparison of Senior Secondary Assessment study which focuses on assessment at pre-university level. We compared the demand of the main assessment available to senior secondary students in England with the main assessments offered in other education systems. In doing so we aimed to identify what can be learned from other systems to strengthen the assessment system in England at senior secondary or pre-university level. Advanced Level General Certificates of Education (A levels) are the main qualifications used to gain entry to higher education in England. A levels are available in over 45 subjects and around 860,000 entries were made in 2011. A levels were therefore the qualifications which we attempted to benchmark with comparable qualifications[2] internationally.

This report presents the findings of this first international comparability study. It sets out the rationale and parameters for the study and the methodology used (section 1). It goes on to give an overview of the education systems and assessments in the

[1] The term “education system” relates to countries, provinces or states that control public education within their borders, and is sometimes referred to as a jurisdiction.

[2] When we refer to qualifications in this document, we are either referring to the programme of study or an examination or series of examinations that gives rise to a result that students use to gain entry to higher education.

jurisdictions involved (sections 2 and 3), before detailing the findings drawn from the analysis of international assessment materials (sections 4–8).

1.2 Scope of the study

In any comparability study, international or otherwise, it is essential to clearly define the scope. Comparability is a broad concept and so providing adequate definitions is critical to the success of a study. These definitions extend to the purpose of the comparability study, the attributes being compared, and the methodology. The methodology will be discussed in full later in the report.

The purpose of this comparison is to assess how the demand of A level qualifications in England matches up to the demand of comparable qualifications in a range of jurisdictions worldwide. When using the term “comparable” in this way, we refer to the fact that there are grounds upon which a comparison can be made. This is linked to a notion of “face comparability” (Elliot, 2011, p.10) – essentially that the comparator qualifications selected appear to be comparable in the sense that they serve the same cohort and have a similar purpose. In this study the similar purpose is entry to higher education.

Comparability studies must be undertaken on a particular “attribute” or variable (Bramley, 2011; Elliot, 2011). Research may focus on syllabus content, the challenge posed by the assessment of syllabus content, student performance or grading standards, for example. As highlighted above, the attribute which forms the basis of this particular comparability study is qualification demand, a combination of the first two of these – put simply, what a student is expected to learn as part of their senior secondary studies and the knowledge and analytical skills they need to use in the assessment of their studies.

To help frame our reviewers’ thinking when making the comparisons in this study we asked them to consider what would prepare a student well for entry to an honours degree level course in the UK. Of course, with a very few exceptions, this is not the specific purpose of the qualifications included in this study. The concept of demand, however, is linked to qualification purpose, and in order to measure it, we needed to redefine each qualification regardless of its original purpose and relationships in a common way to enable meaningful comparisons to be made. Whilst this clearly creates a common purpose that is artificial, some pragmatism is required in such complex studies in order that some sensible basis for comparison can be found.

As a result of this framing, this study is not designed to make judgements on the use of qualifications with regard to their suitability for the purpose they were designed to fulfil. The transition between upper secondary to higher education is managed differently in each education system. While in England, the two-year A level programme typically leads to a three-year degree course, in many countries a full

degree course lasts more than three years, meaning that the transition point between the two levels of education is different.

Additionally, this study is not designed to make judgements about the predictive validity of qualifications, or, whether completing one of these qualifications will lead to success at higher education, in the UK or elsewhere. Universities UK (2003) identified criteria and behaviours that were linked to success in higher education: being self-organised, working well independently, motivation to learn and interest in the subject area. None of these is concerned with what taught or how it was assessed at senior secondary level.

Further, a study by the UK Department for Business, Innovation and Skills (Kirkup et al., 2010) that looked at the predictive power of A levels, GCSEs and an adapted SAT examination, individually and in combination, found that there were a number of factors outside performance in qualifications that were statistically significant when it came to success in higher education.

1.3 What do we mean by "demand"?

While this study is reviewing qualifications which differ greatly in their purpose, content, target student groups and structure, they can all be analysed on the level of "demand" they offer. Elliot (2011, p.11) defines demand as "the level of knowledge, skills and competence required by the typical learner". It is defined alternatively by Pollitt et al. (2007, p.169) as the "requests that examiners make of candidates to perform certain tasks within a question". Within a qualification or assessment it is often related to[3]:

- the amount and type of subject knowledge required to be assimilated
- the complexity or number of cognitive processes required of the student, the extent to which the student has to generate responses to questions from their own knowledge, or the extent to which the resources are provided
- the level of abstract thinking involved
- the extent to which the student must devise a strategy for responding to the questions.

[3] These factors had been identified in a study into question structure by University of Cambridge Local Examinations Syndicate (UCLES) commissioned by QCA. Each factor has the capacity to make examination questions more or less difficult, irrespective of the subject content. The exact interpretation of the four factors is often, to a degree, subject dependent. Explaining any subject-specific aspects was one of the tasks carried out by the lead reviewers.

Demand can be a challenging concept when we consider that it is different from the "difficulty" of a qualification. By "difficulty" we mean how students performed on a question – essentially their success rate. In contrast, "demand" relies on the judgement of experienced professionals as to the challenge that a question should pose, based on the various cognitive processes and knowledge that it requires.

The distinction between the two concepts is illustrated well by Pollitt et al. (2007, p.167), using questions from the Third International Mathematics and Science Study 1996 (TIMSS). In two different mathematics questions on this assessment the success rates of Scottish children were 75 per cent and 76 per cent respectively. Thus both questions were found to be equally difficult amongst this group. In England the corresponding success rates were 59 per cent and 79 per cent; clearly they were not equally difficult here. The questions were both exactly the same. However, they required the same cognitive processes in its solution and were therefore equally demanding. Due to differences in their educational experience, however, the English students found one question more difficult than their Scottish counterparts did. Comparability studies on the attributes of demand or difficulty may therefore yield very different results.

In this study, judgements of demand will be based on the overall qualification standard. Specifically this refers to:

- "specification" or "syllabus" level factors such as assessment objectives, qualification content and structure (such as breadth versus depth of study)
- assessment level factors such as how the content is assessed and what is covered, the weighting of each component and how the assessments are marked, including reference to the level of expected performance indicated by the mark schemes.

1.4 International studies

Making comparisons between any features of international educational systems is notoriously difficult. Despite this, over recent decades there has been a proliferation of transnational comparisons in education. Likewise, in England there has been a new focus on the use of international comparisons to inform policy-making (DfE, 2011a; DfE, 2011b; DfE, 2011c).

This review, like others, is grounded in the conviction that international comparisons allow us "to stand back and achieve a distance from our internal debates" (Allais et al., 2008, p.1). They can help to garner insights and ideas that often cannot be generated by looking inwards at education within England. This is what Oates (2010 p.1) terms "breaking the tendency towards introspection".

These comparisons should not be used to promote crude policy borrowing, rather to present alternative perspectives on familiar issues and practices. Similarly, international comparisons should not be read as an indication that one system of education is "better" than another. There is no "one way" in education as similar polices work with differing success in different circumstances. The indicative findings will only point to possibilities and principles which may be successfully transferable to different contexts.

This issue of context has been at the core of some of the criticisms of the early transnational analyses. These reviews have compared numerous features of international educational systems, from pedagogy, curriculum and assessment to education structures. However:

> The major problem with many of the early forays into this territory was that the methods of investigation adopted were often partial and fairly unsystematic. Too much weight was probably placed on single country comparisons and too little attention was paid to how the parts made up the whole… under-performance in one area… [may have been because]… a topic was not emphasised to the same extent in that country. In the absence of systematic and detailed comparisons it was often difficult to know.
>
> (Gray, in Ruddock and Sainsbury, 2008, p.8; parentheses added)

A number of other reports support this view (see, for example, Robitaille et al., 1993; National Governors Association, 2009; Oates, 2010). As Black (1992) pointed out in the report on the UNESCO-sponsored study on physics examinations used for university entrance:

> It was of course clear that there would be difficulties [in undertaking the comparisons]. An examination in physics, like any other instrument that acquires any operational significance, cannot be understood except as a product of the social and intellectual context in which it functions and for which it is produced. Our study could clearly recognise this, but its capacity to explore the context in depth would clearly be limited.
>
> (Black, 1992, p.2; parentheses added)

The implication of the above is clear; any comparability study which takes one dimension of education in isolation, removing it from its context, is flawed. It is crucial that any variable should not be judged in isolation, and that we acknowledge that assessments are a product of the society, culture, political and educational systems within which they sit. A description of the general features of education systems is further covered in section 2.1.

Taking into account the above criticisms levelled at previous comparability exercises, therefore, this study acknowledges that qualifications, and the assessments that support them, cannot be judged in isolation. This study will endeavour to consider the wider educational and social contexts when drawing conclusions about qualification

and assessment demand. When attempting to learn lessons from other education systems, this appreciation of the context in which they operate is particularly valuable.

The role of international testing and comparability

Of all international comparability work, it is the international achievement tests which have most captured the attention of governments, policy-makers and media outlets. These tests attempt to make comparisons between the achievement of learners, and teaching and learning practices in different countries. They include the Programme for International Student Assessment (PISA)[4], the Progress in International Reading Literacy Study (PIRLS)[5] and the Trends in International Mathematics and Science Study (TIMSS)[6]

A good general description of the process of setting up such international studies is seen in Whetton et al. (2007, pp.3–7) and it is clear that much care is taken in constructing them, quality-assuring them and reporting their findings. England's score in these tests has remained relatively stable over time. As Askew et al. (2010) noted:

> England regularly gets positioned towards the top of the group of second ranking countries and its performance is fairly stable over time. It also needs to be noted that the differences between countries' performance are not that large and are usually statistically insignificant. The horse race approach to the rankings produced by international studies – looking to see which position England is placed in and whether or not it has moved up or down the league tables – is not that meaningful partly because the absolute differences in scores between countries are not that great and partly because the constituent group of comparators changes from study to study and from year to year. Overall, and over time, England's performance is not that worrisome. However, the fact that some countries are consistently ranked highly (Japan, Korea, and Singapore), and some occasionally

[4] PISA is conducted on a three-yearly basis by the Organisation for Economic Cooperation and Development (OECD). It is taken by 15-year-olds and includes the domains of reading, mathematical and scientific literacy. The last full study, conducted in 2009, involved 65 countries and economies.

[5] PIRLS is administered by the International Association for the Evaluation of Educational Achievement (IEA) on a five-yearly cycle. It measures the literacy achievement of children aged 9–10. Approximately 48 countries and 9 benchmarking entities participated in the 2011 study.

[6] TIMMS is administered by the International Association for the Evaluation of Educational Achievement (IEA) on a four-yearly cycle. Participants are aged 9–10 and 13–14 and are tested in the domains of mathematics and science. A total of 63 countries and 14 benchmarking entities participated in the 2011 study.

> dramatically improve (Finland), makes a closer study of such countries worthy of attention.
>
> (Askew et al., 2010, p.9)

Despite this sound performance, the findings of such tests remain a great concern in England (see, for example, Department for Education, 2010a; Eccles, 2010; Paton, 2010; Shepherd, 2010). But as outlined above, there are good reasons to view the findings of such international tests critically (Oates, 2010), not least their role in creating a "league table" view of education systems (Allais et al., 2008). A number of factors may influence the outcomes of the studies and it cannot be assumed that the findings provide a definitive answer about which learners are the highest performing overall.

First, there is an assumption that the items tested for are somehow an objective measure of what is best; secondly, that the learners undertaking the study are a balanced representation of all learners at that stage of education; and also that learners sampled in each country are equally motivated to perform well in the tests (Askew et al., 2010).

Further, all international comparisons, this one included, are subject to the fact that they can only offer a snapshot of one moment in time, which may have been affected by factors in the past that no longer apply. For example, student performance in an examination may be the result of curriculum developments undertaken and subsequently abandoned, investment in education infrastructure some time in the past, or other factors that are no longer in operation in the system being analysed.

The Organisation for Economic Co-operation and Development (OECD) notes that "on their own, cross-sectional international comparisons such as PISA cannot identify cause-and-effect relationships between certain factors and educational outcomes, especially in relation to the classroom and the processes of teaching and learning that take place there" (2011b, p.20).

Acknowledging some of the limitations highlighted above, we have used PISA 2009 results to assist with the identification of other high-performing education systems for inclusion in this study.

1.5 Senior secondary assessment in England – A levels

The qualifications which form the comparator for this international comparability study are the Advanced Level General Certificates of Education, popularly known as A levels. Since its introduction in 1951, the A level has functioned as England's principal pre-university examination. A levels are available in over 45 subjects. The average student will take three or four A levels at around age 18.

To understand the developments that shaped the modern A level, we need to go back some 200 years to the early 19th century. Changes in that century marked the end of education geared heavily to social class and shaped the formation of the modern education and examination system. One driver for this was the steady growth in the number of universities offering degrees which opened up education to a wider group of learners. In 1836 the University of London became the first to offer a degree outside Oxford or Cambridge, and was followed by new "red brick" universities in towns such as Manchester and Leeds. With these came a growth in matriculation examinations to enable objective selection into these institutions (Tattersall, 2007; Gillard, 2011).

As the 19th century progressed, schools looked to universities for guidance on standards in order to better prepare their students for university. Universities responded by establishing boards which provided syllabuses and examinations for students to take in schools. The requirements were specific to the needs of particular universities. Schools were free to pick their preferred board, though most went for a local board. It is these regional examination boards which have evolved into today's national awarding organisations which offer the modern A level.

By the early 20th century, roughly 100 separate examinations existed, with each major profession, as well as the university boards, setting its own conditions of entry. Concerns about the comparability and limited currency of these highlighted a need for a system of examinations in which equivalency could be ensured. This led to the introduction of the Higher School Certificate (HSC) in 1917. This was intended to replace the need for university-specific matriculation examinations, and allow entry into professions. Existing university boards were invited to set, mark and certificate the HSC under the jurisdiction of the Board of Education (Tattersall, 2007).

By the 1950s, aspects of the HSC were causing concern. It was clear that some students were failing the broad qualification because of weakness in a single area. This led to the introduction of the General Certificate of Education examination at A level in 1951, an examination which could be taken on a subject-by-subject basis. Initially the A level was graded as pass or fail, but by 1963 rising numbers of entrants required greater differentiation of achievement. A nationally agreed grading scale was introduced, awarded nominally on the basis of norm referencing[7]. This was maintained until the mid-1980s when guidelines about what proportions should achieve each grade were dropped. More recently, A level assessment changed significantly with the reforms of Curriculum 2000. This led to all A levels changing to

[7] However some authors note that awarding bodies were critical of this grading scheme and therefore did not follow the norm referencing guidelines uniformly (Tattersall, 2007; Newton, 2011).

being made up of two components, the AS and A2, assessed at two examination sessions each year (Tattersall, 2007; Gillard, 2011).

On its introduction the A level was targeted only at the very top of the ability range. However, it has been studied by an increasing number of students and is now taken by over a third of the national cohort. Whilst there are other pre-university examinations available (vocational qualifications, the International Baccalaureate and Cambridge Pre-U, for example), A levels remain the principal tool of university selection in England. During their time in office, the current UK government has signalled their intention to reform A levels to make them the best that they can be. This study will help to inform potential reforms by drawing on the international evidence to learn from high-performing nations worldwide. To support this, we have selected a range of education systems at different stages of their own reform processes.

1.6 Methodology

As with all research programmes, comparability methodology is shaped by the purpose of the study. As defined in section 2.1, this international comparison is being undertaken for the purpose of assessing how the demand of qualifications at senior secondary level in England matches up to the demand of comparable qualifications available in a range of education systems worldwide. A second purpose is to identify what can be learned from other comparable qualifications to strengthen the English assessment system.

One of the most challenging aspects of such research is assessing the comparability of assessments which differ in more ways than simply the difficulty or demand (Newton, 2007a). In this research, we are benchmarking qualifications which can differ greatly in their purpose, content, intended cohort and structure, amongst other things. Any methodology therefore needed to be flexible enough to capture this difference. To ensure that the findings of this study were not just constrained to one area of the curriculum, four subjects were selected for inclusion. These were:

- mathematics
- English
- chemistry
- history.

This decision added significantly to the scale of the study, but was invaluable in allowing general patterns to be identified from education system to education system. These subjects were selected to give a good cross-section of disciplines which are likely to have differing assessment styles.

The approach we used was based on judgemental methods and has been developed from our well-established S*tandards Over Time* programme (see QCA, 2006; Ofqual, 2011). The underpinning analytical tools and forms were reworked to reflect the greater diversity of qualifications under review. This approach also included a mechanism for collecting contextual information on the international qualifications. This was to ensure that judgements about qualification demand were not made in isolation.

Judgemental methods

Judgemental methods require experienced subject and assessment experts to examine syllabus and assessment materials and make judgements as to the demand of comparable qualifications. These methods have been used since the earliest days of comparability monitoring and are a mainstay of educational assessment research.

> [W]hen investigating comparability of assessment, or of qualifications, we have focused mainly on comparing them on the basis of i) the perceived demands (of the syllabus and assessment material); and ii) the perceived quality of examinees' work. Both perceived demand and perceived quality might be thought of as higher-order attributes that are built up from lower order ones. The definition of these attributes suggests that they be investigated by methods that use the judgement of experts.
>
> (Bramley, 2011)

Judgemental methods are particularly important when investigating demand. Pollitt et al. (2007) explain:

> There is no statistical indicator of demands, and no prospect of our developing objective scales for assessing them. Instead we rely on the judgement of experienced professionals.
>
> (Pollitt et al., 2007, p.168)

By their very nature judgemental methods are rarely definitive. They represent the contrasting views of a diverse group of experts taking into account their unique professional experience and standing. Where consistent judgements are made, however, results can clearly signal issues for the attention of policy-makers.

Priorities for investigation

In order to reach judgements on the demand of comparable qualifications at senior secondary level in each of these subjects, there were three priorities for the analysis:

- a consideration of the purpose of each qualification, including target students, an indication of what is considered "success" in the qualification, pass rates, and intended progression following successful completion of the qualification

- a review of the subject-specific materials for each qualification to establish and make judgements around the nature of the subject matter covered – including the topics and sub-topics covered, breadth versus depth of subject coverage, number of optional routes within the subject and accessibility to the range of students targeted by the qualification
- an investigation of the subject-specific assessment instruments to make judgements around issues such as level of demand, the quality of the question papers and mark schemes and the match between the assessment instrument/s and subject syllabus or specification.

The approach used to address these priorities can be split into three broad stages:

- stage 1: desk research to identify suitable education systems and assessments, and to gain the contextual information in which to ground any technical comparisons
- stage 2: review of subject-specific qualification and assessment materials
  - qualification level analysis
  - assessment level analysis
- stage 3: synthesis and reporting.

Stage 1: Desk research and selection of education systems

In late 2010, we carried out detailed desk research to inform the selection of education systems in the study. The aim was to identify education systems which were both desirable to include in the study and had a comparable assessment or qualification at senior secondary level.

Detailed profiles were produced for 26 education systems. These built up a picture of the education system as a whole (structures, recent reforms, and so on), as well as a profile of the relevant assessment at upper secondary level (purpose, target students, progression and so on). We used these profiles in two ways:

- to identify suitable education systems to invite to participate in the study
- to provide the context in which to ground the judgements reached in this review of qualification demand.

One criticism made of some international comparability studies is that they do not sufficiently take into account the myriad of contextual factors which make up an education system. This initial desk research aimed to build our understanding of these contextual factors in order that we could qualify our judgements about international assessments.

Selection of education systems

Using the initial desk research, we invited 22 countries, states and provinces (education systems), as well as Cambridge International Examinations (CIE) and the International Baccalaureate Organisation (IBO) to take part in the study. We also invited the awarding organisations with the highest number of English A level students for each subject.

The education systems that we invited to cooperate in the study were selected in order to:

- include a full range of European Union, Commonwealth and other educational systems representing a breadth of education traditions and economic structures
- include educational systems where the primary language of tuition is not English
- include educational systems with universities rank highly in international comparisons, based on the *World University Rankings 2010* (Times Higher Education, 2010) and *Academic Ranking of World Universities 2010* (Shanghai Ranking Consultancy, 2010)
- take into account the findings of the 2009 PISA survey (OECD, 2010)
- take into account educational systems which have the highest rates of learners coming to the UK to study (Higher Education Statistics Agency, 2010)
- include educational systems at different stages along the reform process.

Participating education systems

Of those that were invited, the following educational systems (with the included assessments / qualifications) accepted:

Australia: New South Wales Higher School Certificate, or HSC

Canada: Alberta Diploma

Denmark: *Studentereksamen*, or STX (Upper secondary school examination)

England: Advanced Level General Certificate of Education, or A level[8]

Finland: *Ylioppilaskirjoitukset* / *Studentexamen* (Matriculation Examination)

France: *baccalauréat général*

Hong Kong: the outgoing Hong Kong Advanced Level Examination, or HKALE; and the incoming Hong Kong Diploma of Secondary Education, or HKDSE

International Baccalaureate Diploma, or IB Diploma (concentrating on Higher Level subjects)

Netherlands: *hoger algemeen voortgezet onderwijs*, or havo (Higher General Continued Education) and *voorbereidend wetenschappelijk onderwijs*, or vwo (Preparatory Scientific Education)

New Zealand: National Certificate of Educational Achievement, or NCEA Level 3

Norway: *Vitnemål fra den Videregående Skole*, or *Vitnemål* (Certificate of Upper Secondary Education)

People's Republic of China: *Gāokǎo* (National Higher Education Entrance Examination)

Republic of Ireland: Leaving Certificate (Established)

Republic of Korea: *Su-neung* (College Scholastic Ability Test, or CSAT)

USA: the ACT

USA: New York State Regents Diploma

University of Cambridge International Examinations A levels, or Cambridge International A levels

University of Cambridge International Examinations Pre-U Diploma, or Cambridge Pre-U.

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[8] Specifications used: OCR Chemistry A; AQA English Literature B; Edexcel History, Mathematics and Further Mathematics.

All of the above qualifications are the main mechanism used by students to gain entry to higher education in their respective system. However, they still differ in purpose. Some are assessments (provided either by the state or by another organisation) with the *specific purpose* of selecting students for higher education (for example, a matriculation examination). Others are assessments of educational achievement that *in addition* are used to identify students for higher education. There is a further distinction within this second type of assessment between those that include the subject area as part of a diploma or baccalaureate-style qualification with one or more compulsory components and those that standalone.

Provision of assessment materials

All participating education systems were asked to contribute materials for each of the four subjects[9] under review – chemistry, English, history and mathematics.

Materials for chemistry, history and mathematics were collected and analysed for each of the 19 qualifications. English was only included where it was one of the national languages or main languages of tuition (12 qualifications).

We provided guidance to each education system on the types of materials usually required in comparability exercises. These requested materials included:

- qualification criteria – the official minimum requirements of a qualification
- qualification structure – where a qualification is a baccalaureate / diploma qualification
- specifications – the detailed description of an individual qualification
- syllabuses – the content studied as part of a qualification
- grade descriptors – definitions of the standard students must achieve for particular grades or scores
- assessment grids – mapping of assessment materials back to the specification or syllabus
- question papers
- mark schemes

[9] In many of the partner qualifications included in this study, the completion of more than one subject is necessary to achieve the qualification. In these cases, the focus of the review was on the specific subject elements that form part of that qualification. For ease of reference whether the subject is an entire qualification, or a part thereof, all elements of the study will be referred to as “subjects”.

- examiners' reports – qualitative details and technical analysis of the assessments carried out for a particular time period
- grade boundaries – cut scores[10] selected to differentiate between levels of student achievement
- grade distribution – number of students within each grade, and how they are distributed at each mark between the boundaries.

Descriptions of each item were provided to our contact within each jurisdiction to account for differences in assessment terminologies between systems. It became apparent that the existence of such documentation varied from system to system so the quantity of materials on which a judgement was based varied accordingly by education system.

Another factor influencing the quality of the materials collected was the home language of the participating jurisdiction. Materials were already available in English for 12 of the education systems in the study. Seven education systems (Denmark, Finland, France, Netherlands, Norway, the People's Republic of China and Republic of Korea) provided their materials in their home language, necessitating a large translation exercise. Whilst careful checking of all translations took place, there is the danger that some of the meaning in the original materials may have been lost or changed slightly in their translated form. All qualifications which were analysed in translation are flagged throughout the report.

As well as being asked to provide the assessment materials, all participating education systems were invited to nominate an individual to join each subject panel and take part in the analysis. Where such participants were provided, their insight was invaluable both in interpreting the assessment materials and in adding context to our understanding of a qualification.

Stage 2: Qualification and assessment level analysis

In order to reach judgements on the demand of comparable qualifications at senior secondary level in each of these subjects, a framework with two elements was identified:

- qualification level factors such as assessment objectives, qualification content and structure (such as breadth versus depth of study), what is assessed and how, and the weighting of each component

[10] A "cut score" is the minimum score a candidate has to achieve in order to get a given grade in a test or an examination.

- assessment instrument level factors including the amount of factual recall as opposed to analytical skills required to generate answers.

This framework is grounded in recent thinking and experience from projects in the area of comparability (Newton et al., 2007; Ofqual, 2011 and takes into account the methods used by comparative studies outside England (such as Black, 1992; Le Métais, 2002; Newton, 2007b, Whetton et al., 2007; Allais et al., 2008; Askew et al., 2010).

To gather judgements on these two elements, four panels of experts were convened (one for each of the subjects in scope – chemistry, English, history and mathematics). Each of these was led by an independent subject expert who is familiar with our scrutiny and comparability studies. The panel memberships were designed to represent a broad spectrum of stakeholders and to bring together a range of different views (including those from higher education, learned societies, subjects associations, awarding organisations and partner educational systems). There were approximately ten members in each subject panel. Due to the different nature of each of the subjects studied, the focus and composition of each panel was very slightly different. A full list of reviewers can be found in Appendix 1.

The first interaction with subject experts began with our briefing of the four panel leaders on 5th November 2010. This set out the aims of the study and was an opportunity for these experienced reviewers to inform the development of the analytical forms or frameworks to be used in the analysis of each subject. A second briefing was then held with all panel members for each of the four subjects, to standardise their approach and ensure their understanding of their role.

Subject experts were then allocated their specific subsets of qualifications for the (individual) home-based analysis. In each panel at least four (but more usually five or six) reviewers considered each set of subject-specific assessment materials from participating educational systems, with every panel member analysing the A level specification as a baseline for comparisons. Therefore, taking into account all four subjects for a certain education system or qualification, approximately 16–20 reviewers will have examined materials from each education system (or 12–16 where English is not a national language). Therefore, whilst we cannot say that these judgements were definitive, a wide range of views on each education system was collected.

Qualification level analysis

This strand of analysis required panels to consider what learners need to know and be able to do to succeed in the assessment. It comprised:

- a factual check of the content covered in the course, the assessment objectives, types of assessment, how the content was assessed and how the answers

were rewarded. It also comprised a fact check of different routes through the qualification where students (or schools) are able to select options as well as core content.

- a comparison made between the above for each of the sets of assessment materials reviewed and A levels.

Reviewers recorded their judgements on a series of bespoke forms that we produce for such purposes. These were adapted where required to take into account any requirements of the four subjects under review. These forms are:

- A form
  Factual analysis of specification or syllabus, question paper and mark scheme. One of these forms was completed for each qualification by each panel member.

- B form
  Comparisons: differences in demand between the sets of subject materials reviewed against A level. In their comparisons subject experts were asked to consider how a B grade student at A level would find the qualification and assessment demand. One of these forms was completed for each qualification by each panel member.

- C form
  Overall summary of key findings and ranking of qualification and assessment demand. One of these forms was completed overall by each panel member.

Assessment level analysis

This second strand of analysis required the panels to make judgements on issues such as the level of demand of assessment materials, the quality of the question papers and mark schemes and the match between the assessment instrument/s and the subject specification or syllabus.

Again, we provided the reviewers with a series of our forms and tools to guide their judgements. These included our A, B and C forms as well as our Complexity, Resources, Abstractness and Strategy (CRAS) form. The CRAS form was developed for our predecessor organisation, QCA. Pollitt et al. (2007, pp. 185–7) describe it as being designed to capture the aspects of a question paper that lead to its demand (see section 1.3 for further details). This CRAS analysis is used as a basis for organising the thoughts of reviewers with regard to specific features at question, task or question paper level.

Panel members were asked to undertake a CRAS analysis by rating the assessment instruments and / or individual questions against a set of factors that are known to affect the demand of questions and against the standard that would be expected of

students prior to entrance to higher education. The ratings use a scale of 1 (below the required level) to 4 (exceeding the required level) and cover:

- the complexity of each component operation or idea and the links between them (for example, simple operations versus synthesis or evaluation of operations)
- the extent to which resources are provided (for example, "all and only the data or information needed is given" versus "student must generate all the necessary data or information")
- the extent to which the student deals with abstract ideas rather than concrete objects of phenomena (for example, "avoids need for technical terms" versus "requires use of technical terms".
- the extent to which the student devises (or selects) and maintains a strategy for tackling and answering the question (for example, "no selection of information required" versus "selecting from a large and complex pool of information").

Some subject panels also chose to develop their own analytical tools at this stage of the review. The chemistry panel, for example, developed a Question Paper Analysis framework to assist with their mapping of demand, required skills and knowledge, and question styles and formats. This framework was used on a question-by-question basis for every assessment by each panel member. The intention was that this would provide a clear and objective overview of the structure, form and nature of question papers, alongside reviewers' own judgements.

Stage 3: Synthesis and reporting

Once individual panel members had completed their qualification and assessment level analysis, completed forms and tools were collated by the subject panel lead. Leads analysed the findings and then synthesised these into a standard report template. We then convened full panel meetings in the spring of 2011 to allow the panels to discuss the conclusions drawn by lead reviewers. Once the four subject reports had been composed, the four panel leads met us in May 2011 to consider the common themes across the four subject areas.

It was the intention that this process should be completed once for this project. It was actually completed twice due to the slightly later sign-up of four countries to the study. France, Norway, the People's Republic of China and the Republic of Korea all signed up to the study once work on the qualification and assessment analysis was already underway. It was decided to complete the first group of 15 qualifications as planned, and then repeat the process on a smaller scale in order to include these four new education systems.

After the analysis and report-writing for the first group of qualifications was completed, a smaller panel was reconvened for chemistry, history and mathematics

and the process was repeated with these additional four education systems. There was no requirement to reconvene an English subject panel due to the fact that none of these four additional education systems had English as a national language or a language of teaching.

Analysis of these additional qualifications was completed during July and August 2011, and the findings were incorporated into the existing report for each subject. A final subject panel briefing was held in August 2011, to confirm that all findings had been synthesised appropriately.

The findings of this process are presented in sections 4–7 of this report.

2 Education systems

This study is not about education systems, but the subject of this study, senior secondary assessment, exists either within the context of an education system or to measure its outcomes in terms of student performance.

The nature of senior secondary assessment is therefore intrinsically linked with the various ways in which countries, provinces, regions, states and independent education providers organise the formal learning opportunities for their population.

The design or evolution of education systems is very specific to the local cultural, economic, and political situation, resulting in a variety of systems operating worldwide as noted by Cambridge Assessment:

> the evidence from overseas requires careful understanding of the nature of the checks and balances within those systems. Some nations such as Singapore, Hong Kong, France and Finland operate a single board model. Conversely assessment in Queensland, Norway and Sweden is highly devolved… The USA has no federal public examinations system and is in the process of developing standards… Germany is in a similar position, with school assessment operated on a regional state basis and is developing overarching qualification criteria.
>
> (Cambridge Assessment, 2011)

The OECD recognises the difficulties such a variety of approaches can cause and has developed a detailed set of indicators with which to measure the current state of education internationally, and to enable comparisons to be made between education systems. These "indicators provide information on the human and financial resources invested in education, on how education and learning systems operate and evolve, and on the returns to educational investments" (OECD, 2011a, p.21).

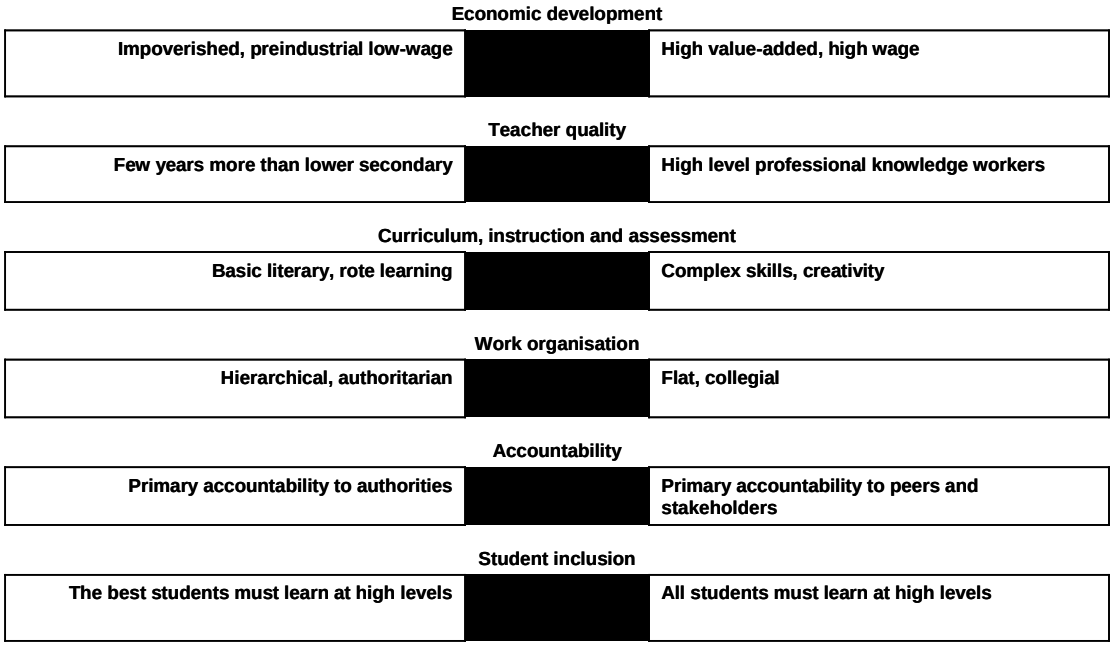
Some understanding of the education systems within the jurisdictions participating in this study will provide a context for comparison and relative judgement of the senior secondary assessments they operate. These are outlined in sections 2.2 and 2.3 and in Table 1 of the Full Report: Table Supplement.

2.1 Constituent parts of an education system

How students are assessed and what they are assessed in is a very important part of an education system, but other considerations around the way in which opportunities for school-based learning and achievement are organised within a system are also important. The OECD identifies four actors in an education system: "individual learners and teachers, instructional settings and learning environments, educational service providers, and the education system as a whole" (OECD, 2011a, p.21).

Although at the highest level most developed education systems appear very similar, more detailed examination reveals that the variable interactions of these four actors create and maintain very different systems.

The OECD expands on the above and describes six dimensions that each have an influence on an educational system. These are economic development, teacher quality, curriculum, instruction and assessment, work organisation, accountability, and student inclusion; "progress along each of these dimensions can be made, at least to some degree, independently of the others – but not without some penalties" (OECD, 2011b, p.18).



(OECD, 2011b, p.17).

Other commentators have identified similar spectrums of factors which may affect the outcomes of learners. For example, Oates cites 13 "control factors" which "exist in complex relations and balances" (2010, p.13). These are:

1. curriculum content (national curriculum specifications, textbooks, support materials, etc.)
2. assessment and qualifications
3. national framework – system shape (e.g. routes, classes of qualifications)
4. inspection
5. pedagogy
6. professional development (levels and nature of teacher expertise)
7. institutional development

8. institutional forms and structures (e.g. size of schools, education phases)
9. allied social measures (such as that which links social care, health care and education)
10. funding
11. governance (autonomy versus direct control)
12. accountability arrangements
13. selection and gate-keeping (e.g. university admissions requirements).

(Oates, 2010, p.13)

Most of the above factors are internal to the education system. There are also a number of external factors which can exert influence over it, sitting outside the control of a jurisdiction's educationalists.

One such factor is the prevailing cultural attitude towards education, including parental expectations and the role of education in society. Cultures based on the Confucian tradition, for example, are recognised as placing a very high value on education and students' achievement in school. The link between cultural attitudes (and parental expectation) and high achievement has been highlighted in a number of studies (see OECD, 2011b). In particular, Askew et al. noted that "high attainment may be much more closely linked to cultural values than to specific mathematics teaching practices" (2010, p.12). Other external factors include the level of economic development and wider policy issues such as funding.

The overall performance of an education system will depend on how these different elements inter-relate. Indeed, Oates (2010) details the need for the control factors he describes to be aligned in order to support a coherent education system.

However, education systems reach this alignment in a variety of ways, influenced over time by a number of different factors, some or all of which may no longer be evident, and therefore may often be overlooked.

Historically the influences have come from within society itself, often from the elite group which exercised political control. For example, the legislation enacted in Finland in 1686 to make literacy a requirement for marriage is widely credited as the basis for the high importance education has in modern Finnish culture (Oates, 2010).

However, more recently, shifts in an education system have been influenced by outside factors, including reference to what takes place in other parts of the world. For example, in the early 1990s the Brazilian government recognised that the existing model of having a highly educated elite, but over 75 per cent functional illiteracy seriously restricted Brazil's competitiveness in global markets, prompting change to the system led by central agencies (OECD 2011b).

In contrast to this, access to education for a very high proportion of the population of the USA has been a feature for many years: 96 per cent by age enter upper secondary (UNESCO, 2008) and 76 per cent by age graduate (OECD, 2011a). But reform was still seen as important to address increasing concerns about the achievement gap amongst different parts of the population, leading to cooperative efforts by the federal and state governments to agree common curriculum content and standards.

Another potentially significant driver in the alignment of education system dimensions or control factors relates to financial constraints. For example, recent monitoring work carried out by UNESCO during 2009 in response to concerns about the impact of the global financial crisis identified that national education budgets were being maintained or even increasing as a proportion of total national budgets in the face of the global financial crisis, but many were decreasing in real terms with inevitable impacts upon educational provision (Gwang-Chol Chang, 2010).

2.2 Education systems

The structures and other key features of the education systems included in this study vary greatly. They differ in what proportion of young people progress into upper secondary education, how this education is regulated and the assessments administered. There are also very different models for how access to higher education is controlled. A table outlining these and some other key features of the education systems in this study is included in Table 1 in the Full Report Table Supplement and is detailed country by country in section 2.3 below.

In England over 90 per cent of young people complete senior secondary education with almost half of these gaining A level qualifications at the end of their studies. There are similarly high levels of completion or graduation in Denmark, Finland, France, the Netherlands, New Zealand, Norway, the Republic of Ireland and the Republic of Korea (OECD, 2011a).

This is in contrast to Hong Kong where just over half of young people complete senior secondary education. Partly because of this relatively low completion rate, a new education system is now being introduced with a new qualification replacing the Hong Kong HKALE. The first cohort of students will complete the new HKDSE in 2012. The HKDSE has been designed to include and recognise both academic and vocational courses for a broader range of students. As a result the current HKDSE final year has over twice as many students as the previous HKALE annual cohort (Government of the Hong Kong Special Administrative Region Education Bureau, 2012)

Hong Kong, with a population of 7.1 million, is typical of the size of population that a single education system caters for, as reviewed in this study. The regulation and administration of qualifications and examinations is most often held at national level,

for example Denmark, New Zealand and the Republic of Ireland, who also each have a population of around 4–7 million people. Some examples of this are presented in Table A. Two out of the three systems included in the study that are administered at a provincial or state level, Alberta and New South Wales, are also a similar size (the exception being New York State with a population approaching 20 million).

Countries such as France and England (with populations of around 63 and 52 million people respectively) are unusual in having single education systems that cater for such large populations. In other large systems in this study (the Republic of Korea and the People's Republic of China) there is a combination of local and national control. While it is the case that the examinations included in this study are national, much control of the education system itself lies at a more local level. In the Republic of Korea, many decisions are made by the seven municipal and nine provincial district offices of education rather than by the central government (International Review of Curriculum and Assessment Frameworks Internet Archive, 2010). In the People's Republic of China responsibility for aspects of the education system, including text books, school examinations, finance and teaching are devolved to a local level (OECD, 2011b, pp.85–98). The city of Shanghai is an example of one of these local level units, and with a population of just over 20 million, the education system caters for a similar size population as the New York State Education Department.

Education system	Control of education system	Population	Number of students taking the qualification included in this study
Alberta	Provincial level	3.7 million	45,286
Denmark	National level	5.5 million	51,178
New South Wales	State level	7.1 million	68,409
New York State	State level	19.5 million	224,744
England	National level	52 million	250,000
France	National level	63.1 million	328,467

Table A: Examples of population and qualification figures for education systems included in this study

In most of the education systems there is a central organisation which administers the senior secondary assessments considered by this report, although this may not be under governmental control. In Denmark, for example, assessments are managed directly for all students by the Ministry of Children and Education. In contrast the Finnish universities provide the assessment materials offered by the independent Matriculation Examination Board to all general studies students, whereas in Norway the Ministry of Education and Research administers the assessments but students

are selected to sit a maximum of five external examinations (including Norwegian) from the nine or more subjects studied. The Republic of Ireland has the State Examination Commission, while in England the requirements or criteria for A levels and other qualifications are specified by Ofqual.

As regulator, we also monitor the A level providers to ensure standards are maintained and the assessments are administered appropriately, but the course content is designed and the assessments are administered by one of the five A level providers.

Where the responsibility for education is at state, province or territorial level there are often initiatives at national level as governments attempt to tackle recognised differences in the achievement of students across the country. For example the United States has high-profile federal campaigns such as the continuing “No Child Left Behind” policy based on the 2001 Act, together with close cooperation between all 50 states leading to the adoption of the “Common Core Standards” for mathematics and English language arts. There is also the National Assessment of Educational Progress (NAEP) programme which collates data on educational achievement across the country. However there is currently no national programme to assess student achievement and the administration of education is still largely devolved to the school districts with schools encouraged to develop their own courses which meet and expand upon the state requirements.

In 2008 the Australian national, state and territorial governments jointly introduced the National Assessment Program – Literacy and Numeracy (NAPLAN) to all Australian schools. The data from these assessments has been used to identify successful schools as a potential source of good teaching practices which will be shared nationally. Additional funding has also been provided by the national government to support teacher development and additional resources in disadvantaged schools (Garrett, 2012).

Almost all of the education systems in this study assess students in their final two years of study which means most have completed 11 or more years of study before taking their final assessments. New York State is the exception as the Regents Diploma examinations can be taken from Grade 9 onwards. Each subject in the Regents is designed to be taken in a particular grade (school year), therefore both course content and assessment take into account the student’s age and the years of study. This approach spreads the assessment load across the student’s senior high school career, although very capable students may choose to complete their Regents Diploma examinations early in order to concentrate on college preparations in the last years of high school.

The way in which education systems incorporate both academic and applied or vocational subjects and the nature and content of the assessments offered is covered in detail in section 3.

In England students study primarily academic subjects to the end of compulsory schooling at age 16, although there are increasingly options for more practical studies. Post-16 the A level courses provide the academic route taken by about 45 per cent of students. The remainder start work and / or training leading to a vocational qualification. Choosing an equivalently demanding course of vocational study does not exclude a student from university, and may be an advantage for particular university degree courses.

By contrast, in the Netherlands a student's choice of study route at the beginning of secondary education determines their access to higher educational opportunities. Some secondary schools allow flexibility in course choices up to the end of the first year of study. There are two study programmes designed to prepare students for degree-level studies, but a student in the technical programme (havo) who wishes to apply for an academic university must complete a conversion course before they can apply. Denmark has a similarly structured secondary education system.

What Denmark, England and the Netherlands do have in common with Finland, France and Norway is that at some point in secondary education there is a clear separation of academic and vocational study programmes and outcomes.

In New South Wales, New Zealand, and the Republic of Ireland the programme of study can include both academic and vocational courses leading to the same overall qualification. However, a student in the New York State can only graduate from high school by obtaining the New York State Regents Diploma which requires them to demonstrate sufficient academic achievement. This does not prevent students from including vocational courses in their individual programme of study, but there is a compulsory academic core. The approach in Alberta is similar although the education system is less rigid about the time within which a student is expected to complete their diploma examinations.

Very academically capable students in both New York State and Alberta are actively encouraged to move through the school grades more quickly, enabling them to achieve their diploma earlier than usually expected. Both Alberta and New York State fund comprehensive college preparation programmes including use of commercially provided study and assessment programmes.

In all the education systems included in this study success in the senior secondary assessments increases, but may not guarantee, opportunities for continued studies. In New Zealand a student must complete their senior secondary education with a minimum level of achievement in order to be considered for university. Students in

Canada and the USA aiming for top universities expect to complete high school and then further college preparation before applying.

In Finland, passing the Matriculation Examination entitles a student to continue their studies at a Finnish university. However, it is not so straightforward for students in the People's Republic of China and the Republic of Korea. In the *Gāokǎo* (People's Republic of China) and CSAT (Republic of Korea) university entrance examinations students are allocated a rank or score which can only be used in support of the current year's applications for university places. Students wishing to defer university entrance must retake the series of assessments in the year they wish to enter university.

2.3 Education system profiles

In this section we outline some of the key features of the education systems included in this study. This includes a brief outline of each education system as a whole with a focus on the nature and context of the senior secondary assessments which allow students to apply for university places. These profiles are supported by information contained in Table 1 of the Table Supplement to this report.

Australia – New South Wales

Located in the southern hemisphere, Australia consists of the mainland of the Australian continent, the island of Tasmania, and a number of smaller islands in the Indian and Pacific Oceans. Australia is a federal nation consisting of six states and two territories and has a population of 21.9 million (Australian Bureau of Statistics, 2009).

Responsibility for education policy and provision is devolved to state and territory legislatures although there is active cooperation with two key national agreements reached in 2008:

- Council of Australian Governments (COAG)
  The Intergovernmental Agreement of Federal Financial Relations and the National Education Agreement resulted in a common framework for reform to education.

- Ministerial Council on Education, Early Childhood Development and Youth Affairs (MCEECDYA)
  The Melbourne Declaration on Educational Goals for Young Australians outlined new national goals for schooling (Australian Government Department of Education, Employment and Workplace Relations, 2010).

In addition, the Australian national curriculum in English, mathematics, science and history for Kindergarten to Year 10 was published in 2011. A national senior secondary curriculum and the Australian curriculum for languages, geography and the arts are under development (Australian Curriculum Assessment and Reporting Authority, 2011).

School education is compulsory between the ages of 6 and 16 (Years 1 to 10) and comprises 13 years, including the non-compulsory preparatory year prior to Year 1 and senior secondary Years 11 and 12 (Australian Government, 2012).

The Australian Qualifications Framework (AQF) provides guidelines for the Senior Secondary Certificate of Education (local titles are used at state / territory level) which is used to certify the completion of secondary education. Requirements for the Senior Secondary Certificate of Education are set by statutory bodies for each state or territory (AQF Advisory Board, 2007).

At 7.1 million New South Wales (NSW) has the largest population of any Australian state or territory and contains over a quarter of the Australian universities (Australian Education Network, 2012). Two of these, the University of Sydney and the University of New South Wales, are ranked amongst the best in the world (Times Higher Education, 2010).

In NSW the Senior Secondary Certificate of Education is called the Higher School Certificate (HSC) and is awarded by the Board of Studies NSW. The Office of the Board of Studies NSW is the statutory body responsible for NSW curriculum development, assessment of student performance (including the HSC) and the registration and accreditation of non-government schools and home schooling (Board of Studies NSW, 2012a).

After awarding the HSC, the Board of Studies NSW provides raw student HSC scores to the University Admissions Centre for calculation of each individual's Australian Tertiary Admission Rank (ATAR), a rank which allows comparison of students who have completed different HSC course combinations.

Almost 84 per cent of the labour force in NSW has completed Year 12 level education (Australian Bureau of Statistics, 2011) although individuals may not have received the HSC, as alternative qualifications are available to reflect different programmes of study and levels of achievement (AQF Advisory Board, 2007).

Whilst there is no overall OECD data available on upper secondary graduation rates, data would indicate that for Australia as a whole, the graduation rate from a general upper secondary education is 67 per cent and a vocational upper secondary education is 44 per cent (OECD, 2011a).

University admissions

Australia does not have a central body responsible for administering admissions to tertiary education, although there are organisations such as the Universities Admissions Centre (UAC) and Queensland Tertiary Admissions Centre (QTAC) which manage admissions for particular groups of institutions.

Completion of Year 12 evidenced by a suitable level of achievement in the Senior Secondary Certificate of Education is acceptable for admission to an Australian university, although specific courses do have particular subject requirements.

The ATAR can also be used for admission to some institutions as this rank allows the comparison of students who have completed different combinations of senior secondary subject courses. The ATAR is calculated solely for use by these institutions to rank and select school leavers for admission to tertiary courses. Other selection criteria may be used together with the ATAR (Universities Admissions Centre, 2012).

Single-subject courses of full-time study are typically two years for an associate degree, three years for an ordinary degree and four years for honours. Joint-subject courses can last up to seven years.

Canada – Alberta

Canada is a federal nation in North America consisting of ten provinces and three territories. Spanning over 9.9 million square kilometres, it is the world's second-largest country by total area and has a population of 34.1 million (Statistics Canada, 2010). There is no national ministry or department for education because the provincial legislatures have exclusive powers concerning matters of a local nature, including education policy and provision. Some national education organisations do exist however;

> In 1967 ministers of education from across Canada founded the Council of Ministers of Education, Canada (CMEC) as an intergovernmental body to serve as:
>
> a forum to discuss policy issues
>
> a mechanism through which to undertake activities, projects and initiatives in areas of mutual interest
>
> a means by which to consult and cooperate with national education organisations and the federal government
>
> an instrument to represent the education interests of the provinces and territories internationally.
>
> (Council of Ministers of Education, Canada, 2012)

The ages for compulsory schooling vary from jurisdiction to jurisdiction. Most require attendance in school from age 6 to age 16, although in some provinces it may extend to age 18 or until graduation from secondary school. All jurisdictions have some form of pre-elementary (kindergarten) education, operated by the local education authorities. Depending on the jurisdiction, "kindergarten may be compulsory and pre-school classes may be available from age 4 or even earlier" (Council of Ministers of Education, Canada, 2012).

Alberta is the fourth largest province by population (3.7 million; Statistics Canada, 2010) and contains over 10 per cent of Canada's universities (Association of Universities and Colleges of Canada, 2012). One of these, the University of Alberta, is ranked amongst the best 200 in the world (Times Higher Education, 2010).

Alberta Education is the provincial government ministry for education. The ministry "supports the needs of students, parents, teachers and administrators from Early Childhood Services (ECS) through to Grade 12" and has responsibilities for education and schools across the province (Government of Alberta, 2012a). These

include defining the Alberta Diploma requirements which students must complete in order to graduate from high school (Government of Alberta, 2012a).

Almost 77 per cent of the labour force in Alberta has completed Grade 12 level education although individuals may not have received a high school diploma as alternative qualifications are available to reflect different programmes of study and levels of achievement (Statistics Canada, 2006). In 2009, 91 per cent of Albertans aged 25–34 reported they had completed high school (Government of Alberta, 2010a).

Whilst there is no directly comparable data, statistics from the OECD (2011a) indicate a total first-time graduation rate from senior secondary education of 79 per cent for Canada as a whole. For students aged under 25 years, this rate is 75 per cent. The vast majority of this graduation is from general education which has a graduation rate of 76 per cent, compared with 3 per cent for vocational education.

University admissions

Canada does not have a central body responsible for administering admissions to tertiary education. Institutions act independently by defining the level of achievement (including completion of senior high school) they expect from applicants.

Although most universities have a range of entrance paths and requirements, students typically enter at Bachelor level after successful completion of secondary school or the two-year *Collège d'enseignement général et professionnel* (Cégep) programme in Quebec. Bachelor degrees usually require three or four years of full-time study, depending on the province and the nature of the programme (Council of Ministers of Education, Canada, 2012).

Denmark

With a population of 5.5 million (Denmark.dk, 2012a), the Kingdom of Denmark is the smallest of the Scandinavian countries and includes two autonomous provinces – the Faroe Islands and Greenland (Denmark.dk, 2012b).

Education in Denmark is governed by government ministries and managed locally by local authorities in cooperation with school boards. The Ministry of Children and Education is responsible for early childhood education and care, primary and secondary education and the Ministry of Science, Innovation and Higher Education is responsible for higher education institutions (Ministry of Children and Education, 2012a).

In Denmark, students are required to complete ten years of education between the ages of 6 and 16 (primary and lower secondary) with around 13 per cent of the children taught outside the state school system in private independent schools (Ministry of Foreign Affairs of Denmark, 2009). There are 14 years of school

education in total, including the non-compulsory additional lower secondary (Year 10) and senior secondary (Years 11–13) (Eurypedia, 2011a).

Students in upper secondary education are usually aged between 16 and 19 (or 17 if they have chosen to undertake the optional Year 10). Upper secondary education takes between two and five years depending upon the route taken. There are four different upper secondary education programmes in Denmark:

- the traditional general upper secondary education offered in the *Gymnasium* (senior secondary school): the *Studentereksamen*, or STX (Upper Secondary School Examination) and the *Højere Forberedelseseksamen*, or HF (Higher Preparatory Examination; Ministry of Children and Education, 2012b and 2012c)
- the vocationally orientated general upper secondary education: *Højere Handelseksamen*, or HHX (Higher Commercial Examination) and *Højere Teknisk Eksamen*, or HTX (Higher Technical Examination; Ministry of Children and Education, 2012d and 2012e).

Although the different programmes are offered in different institutions, the common subject courses often have the same core curriculum and examinations (Ministry of Children and Education, 2012f). The different programmes also have common objectives, specifically to "prepare young people for higher education, and in that connection ensure that they acquire general education, knowledge and competences by means of the subjects they study and in the interaction between them" (Ministry of Children and Education, 2012g).

According to OECD statistics, the total first-time graduation rate from upper secondary education in Denmark is 85 per cent (75 per cent amongst those aged25 years or under). The graduation rate from general programmes (55 per cent) is slightly higher than for vocational programmes (47 per cent) in Denmark (OECD, 2011a).

Around 34 per cent of the working population in Denmark have completed higher education (Statistics Denmark, 2011). The Danish government's goal is that at least 50 per cent of a youth cohort are to have a higher education in 2015 (Ministry of Children and Education, 2012h).

University admissions

Admission to most courses of higher education in Denmark is managed through the *Koordinerede Tilmelding*, or KOT (Coordinated Enrolment System). The general admission requirement is the completion of one of the four courses of senior secondary education, although particular courses do have specific requirements (Ministry of Children and Education, 2011a).

Single subject courses of full-time study are typically three years for a Bachelor degree (University of Copenhagen, 2011).

Denmark has three of its universities ranked within the best 200 in the world. These are the Technical University of Denmark, Aarhus University and the University of Copenhagen (Times Higher Education, 2010).

England

England is one of the four nations of the UK. It is located to the west of continental Europe and comprises the central and southern part of the island of Great Britain. With a population of 52.2 million, it has 80 per cent of the population of the UK (Office for National Statistics, 2011).

Following the devolution of responsibilities from the UK central government to national governments, education policy for England is managed by the Department for Education (DfE) supported by a number of governmental bodies. Local authorities are generally responsible for the provision of state-sector schooling in accordance with the DfE's policies, although the DfE is now encouraging successful schools to consider Academy status and independent groups to develop Free Schools. Both Academy status schools and Free Schools receive public funding but operate outside local authority controls.

School education is compulsory between the ages of 5 and 16 (Year 1 to Year 11). In total it comprises 15 years, including the non-compulsory part-time nursery and full-time Reception prior to Year 1 and senior secondary Years 12 and 13.

Qualifications commonly accepted for university entrance in England include A levels, the International Baccalaureate Diploma and Cambridge International A levels. Additional qualifications at level 3 (pre-university), for example the Diploma, the Cambridge Pre-U and Extended Project have recently been developed. At Ofqual, we regulate the assessments for qualifications available within state-funded English schools and the various awarding organisations that develop and provide them.

Senior secondary education in England includes a wide variety of courses from academic subjects through to vocational courses equipping students directly for the world of work, with 92 per cent of UK students completing some form of senior secondary education (OECD, 2011a). Over 55 per cent of students go on to study at universities, primarily in the UK (UNESCO, 2008). In 2009 over 360,000 UK-based students began undergraduate university studies in England (Higher Education Statistics Agency, 2011).

University admissions

Higher education is the responsibility of the Department for Business, Innovation and Skills (BIS). Each university, and courses within them, may have their own particular entry requirements, and offers of places are made on the basis of applicants meeting specific conditions. One of these conditions usually relates to a minimum number of Tariff points allocated by the Universities and Colleges Admissions Service (UCAS). Applications to tertiary education across the UK, including English universities, are managed by UCAS, and the tariff system allocates points to all the different qualifications used for entry to higher education. This enables students to use a range of qualifications to secure a place on an undergraduate course.

Whilst tariff points are often specified in entry requirements for higher education institutions (HEIs), other factors may be taken into account, such as the quality of an applicant's personal statement and references (UCAS, 2012a). These conditional offers are usually made based on Tariff points, actual qualification grades or a combination of the two. According to UCAS, "in 2010, 54.6 per cent of all offers made through UCAS used Tariff points or a combination of Tariff points and qualifications" (UCAS, 2012b).

Single-subject courses of full-time study are typically two years for a foundation degree and three years for an honours degree (UCAS, 2012c).

England has 24 universities ranked amongst the best 200 in the world. Of these four are within the top 40 institutions globally: University of Cambridge, University of Oxford, Imperial College London and University College London (Times Higher Education, 2010).

Finland

Finland is a Scandinavian country located in northern Europe, with a population of 5.4 million (Statistics Finland, 2011). It became an independent republic following the Russian revolution in 1917.

The Ministry of Education and Culture is responsible for publicly funded education in Finland. It is accountable for "preparing educational legislation, all necessary decisions and its share of the state budget for the government" (Eurydice, 2010). It is supported in its work by several expert bodies, including the Finnish National Board of Education which determines the national core curriculum.

The intention in Finland is that "pre-primary education, basic education and upper secondary education and training, complemented by early childhood education and before- and after-school activities, form a coherent learning pathway that supports children's growth, development and well-being" (Eurydice, 2010). Starting at the age of 7, students have to complete nine years of education (primary and lower secondary), which is available in Finnish, Swedish, Sami, Roma and sign language.

In all, there are 13 years of school education including the voluntary year of pre-primary education and three years of upper secondary education.

Throughout education, national assessments are used to sample student achievement, but individual student achievement is measured and certified by schools (except for the Matriculation Examination described below).

Upper secondary education consists of general education leading to entry in the Matriculation Examination, or vocational education and training which leads to vocational qualifications and further and specialist qualifications.

In 2009 over 50 per cent of students completing compulsory education continued on to upper secondary general education. Historically, most students in general education at this level will attempt the Matriculation Examination (STX). Of these students just under 20 per cent will continue into a university education, and just over 20 per cent will continue into technical and vocational studies, usually to degree level. Students who study vocational subjects at senior secondary level also have the opportunity to continue into degree-level studies (Statistics Finland, 2010a).

A total of 95 per cent of the Finnish population complete some kind of upper secondary education (with a graduation rate of 84 per cent in the under-25s). Graduation rates from vocational education (50 per cent) are slightly higher than those for the competitive general programmes (47 per cent) (OECD, 2011a).Around 28 per cent of the working population in Finland have completed higher education (Statistics Finland, undated).

University admissions

Admission to ten of the universities in Finland is coordinated through University Admissions Finland, although all institutions manage their own admission processes. Students must provide evidence their senior secondary general or vocational diploma, including the Matriculation Examination. Specific courses may also have particular requirements (University Admissions Finland, 2012).

Single-subject courses of study are typically three to five years leading to a Bachelor degree (Ministry of Education and Culture, 2012a).

One Finnish university (University of Helsinki) is ranked within the top 200 universities in the world (Times Higher Education, 2010).

France

France is a European republic with a population of 63.1 million (Institut national de la statistique et des études économiques, 2011). It is the largest western European country and consists of 22 metropolitan regions (including the island of Corsica) and five overseas regions.

France has a centralised system for education with responsibility for the content of the instruction and examinations held by the Ministère Éducation Nationale Jeunesse vie Associative (Ministry for Education, Youth and Community Life). However, administrative responsibility for education at a regional level is undertaken through 28 regional academies, each of which is headed by a *Recteur,* who is a civil servant appointed by the Ministry. *Recteurs* are required to implement national policy and also to manage local education services (Ministère Éducation Nationale Jeunesse vie Associative, 2011a).

The Ministry for Education, Youth and Community Life., is responsible for all standardised testing, acting as the awarding organisation for national qualifications at primary and secondary level. The Ministère de l'Éducation Nationale, de l'Enseignement Supérieur et de la Recherche, or MENESR (Ministry for National Education, Higher Education and Research) is responsible for higher education.

School education is compulsory between the ages of 6 and 16 (primary and lower secondary education). In total it comprises 16 years, including the non-compulsory pre-school education and two non-compulsory senior secondary years (*première* and *terminale*) before students take the *baccalauréat* assessment at the end of their senior secondary schooling.

Upper secondary education (*lycée)* consists of two cycles. The direct cycle (*seconde*) is compulsory and the syllabus is similar for all students except for those who follow a vocational programme. The final cycle lasts for two years and consists of the *première* and *terminale* classes. Students must choose one of three general streams or from seven technological streams or from the wide range of vocational programmes.

Following the completion of the upper secondary education three qualifications are awarded:

- *baccalauréat général* (general baccalaureate)
- *baccalauréat technologique* (technological baccalaureate)
- *baccalauréat professionnel* (vocational baccalaureate).

To be awarded the qualification students must complete the academic programme and then take the *baccalauréat* examination (Eurypedia, 2011b).

Whilst there are no overall graduation rates available, 50 per cent of the French population have graduated from a general upper secondary education, with 62 per cent completing a vocational programme at the equivalent level (OECD, 2011a).

In 2011, 71.6 per cent of the French adult population had completed general secondary education: 36.5 per cent with the general baccalaureate, 16.2 per cent with the technological baccalaureate, and 18.9 per cent with the vocational baccalaureate.

University admissions

Higher education in France includes state-funded universities and the *Grande École*, (Great School). Admission to the state-funded universities is open to any student who has achieved a pass in their chosen *baccalauréat*. Applications are managed online by MENESR (Ministère de l'Enseignement Supérieur et de la Recherche, 2012).

Admission to the *Grande École* is extremely competitive. Most students study for a further two to three years in "*classes préparatoires aux grandes écoles"* (CPGE) before taking the selection examination. This process is supported by the Ministry (Ministère de l'Enseignement Supérieur et de la Recherche, 2011). Single-subject courses of full-time study are typically three years to achieve the *Licence*, or honours degree.

Four French universities are listed amongst the world's top 200 universities. These include École Polytechnique, École Normale Supérieure – Paris, École Normale Supérieure (ENS) de Lyon and Pierre and Marie Curie University (Times Higher Education, 2010).

Hong Kong

Hong Kong is a Special Administrative Region (SAR) of the People's Republic of China. Prior to 1997 Hong Kong was governed from the UK and the handover to Chinese rule provided the opportunity for reform in a number of areas of government including education. A city-state situated on China's south coast, Hong Kong has a population of 7.1 million (Government of the Hong Kong Special Administrative Region Census and Statistics Department, 2011).

Hong Kong maintains its own system of education under an Education Bureau (EDB) which reports to the Hong Kong government (OECD, 2011b). An Education Commission advises the Secretary for Education on the overall educational objectives and policies. The Hong Kong education system is currently undergoing significant reform. The *Reform Proposals for the Education System in Hong Kong* were first submitted by the Education Commission (EC) to the Hong Kong government in September 2000 (Education Commission, 2000). These proposals included reforms to the curricula, assessment arrangements and changes to the admission systems for the different stages of education. Many of these reforms are already taking place, and the Hong Kong government is putting in place support measures for schools and teachers to assist their smooth implementation. The scope of the reform covers the curricula, the assessment mechanisms as well as the admission systems for different stages of education. The government has published

a timetable for implementing the reform measures. Support measures for schools and teachers are being put in place to ensure that the reform can be implemented smoothly (Government of the Hong Kong Special Administrative Region Education Bureau, 2007).

From 2008, the government of Hong Kong Special Administrative Region changed the policy of nine years' free and compulsory education (which included the first three years of secondary education) to 12 years' free education. In total it now comprises 15 years, including the three non-compulsory kindergarten years prior to Primary P1 and senior secondary years S4 to S6 (Institute of International Education, 2012).

Students who started their secondary education before 2006 (prior to the reforms being implemented), and decided to continue their academic studies after secondary year S3 (age 15) would study for two years (senior secondary years S4 and S5) for the Hong Kong Certificate of Education Examination (HKCEE), which selected about one third of the annual student cohort for the sixth form and then a further two years (senior secondary years S6 and S7), before taking the Hong Kong Advanced Level Examinations (HKALE) (Hong Kong Examinations and Assessment Authority, 2008a and 2011).

As a result of the recent reforms, all students who started their secondary education from 2006 onwards are given the opportunity to continue until S6 and complete the Hong Kong Diploma of Secondary Education (HKDSE). The first cohort of students are due to complete their HKDSE in 2012 (Hong Kong Examinations and Assessment Authority, 2012a). The HKALE, HKCEE and HKDSE are developed and delivered by the Hong Kong Examinations and Assessment Authority (HKEAA).

Whilst there is no OECD data available on Hong Kong graduation rates from upper secondary education, some figures are available from the Government of the Hong Kong Special Administrative Region Census and Statistics Department (2010). These show that 52 per cent of Hong Kong's population above the school leaving age have completed senior secondary education and around 35 per cent of these went on to complete a degree course.

University admissions

The Joint University Programmes Admissions System (JUPAS) is the central body responsible for administering admissions to the eight publicly -funded universities in Hong Kong; these include four universities considered to be amongst the best 200 in the world: the University of Hong Kong, Hong Kong University of Science and Technology, Hong Kong Baptist University and Hong Kong Polytechnic University (Times Higher Education, 2010).

Once they receive their examination results students complete an application on which they list in preference order up to 20 courses of study at the JUPAS

participating institutions. Applications for each course are then ranked by merit by the institution. JUPAS processes the course applicant merit order in combination with the individual applicant's preferences in order to identify the best possible offer for each applicant (Joint University Programmes Admissions System, 2012a).

The year 2012 will be a double cohort year when the last cohort of students under the old structure and the first cohort of students under the new structure will graduate from upper secondary school in parallel. Nevertheless, the Education Bureau announced in July 2006 that there will be double provision of university places for students of the old and new systems (that is 15,150 for each cohort). There will be no competition for university places between S7 students of the existing system and S6 students of the new system (Education Bureau, 2012).

Each university sets the admission requirements for specific courses of study, but the general entrance requirement (GER) is set by agreement between the University Grants Committee (UGC) and of the Heads of Universities Committee (HUCOM) (Hong Kong Examinations and Assessment Authority, 2012a).

Post-HKALE courses of full-time study are typically three years for an honours degree and post-HKDSE courses of full-time study are typically four years for an honours degree (Joint University Programmes Admissions System, 2012b).

International Baccalaureate Organisation

The International Baccalaureate Organisation (IBO) is a not-for-profit educational organisation, founded in Geneva, Switzerland in 1968. It was conceived as a single programme for internationally mobile students preparing for university and has since grown into three programmes for students aged 3 to 19.

The IBO works with 3,333 schools in 141 countries to offer the three IB programmes to approximately 994,000 students aged 3 to 19 (figures provided by IBO, February 2012). These three programmes are: the Primary Years Programme (PYP), the Middle Years Programme (MYP) and the Diploma Programme. The programmes can be offered individually or as a continuum (International Baccalaureate Organisation, 2012a).

University admissions

The IBO works with universities in nearly 140 countries to promote recognition of the International Baccalaureate (IB) Diploma. The IB Diploma is now accepted by universities around the world, including those in North America, the UK, Australia and continental Europe. The majority of IB Diploma graduates enter higher education. The latest statistics from the IBO suggest that 120,000 IB Diploma Programme graduates enter university each year (International Baccalaureate Organisation, 2012b).

The Universities and Colleges Admissions Service (UCAS) which manages applications for courses at universities within the UK accepts both the IB Diploma and the Diploma Programme Courses in support of applications. In addition, students who register for an IB Diploma but do not achieve all elements or do not achieve the pass mark of 24 points can gain Tariff points from their achievement in individual courses of the IB Diploma. These include core requirements of: extended essay; theory of knowledge (TOK) and creativity, action, service (CAS) (UCAS, 2012a). Within the UK nearly 2 per cent of full-time degree entrants hold an IB Diploma (figures provided by IBO, February 2012).

Netherlands

The Kingdom of the Netherlands consists of the Netherlands itself and six islands in the Caribbean Sea: Aruba and the Netherlands Antilles (Dutch Embassy, 2012). The Netherlands has a population of 16.7 million (Centraal Bureau voor de Statistiek, 2011).

The Dutch education system combines a centralised education policy with decentralised administration and management of schools. The involvement of the provincial authorities mainly takes the form of statutory supervisory and judicial duties, while the municipal authorities have certain statutory powers and responsibilities towards both public and private schools. All schools receive funding from the national government through the Ministry of Education, Culture and Science and are subject to review by the Dutch Inspectorate of Education.

Full-time school education is compulsory from the age of 5 for at least 12 full years, and is expected to continue until a basic educational qualification has been obtained (Ministerie van Onderwijs, Cultuur en Wetenschap, 2012a).

After completing their primary education, students choose one of the available secondary programmes based on the advice of their school and the outcomes of the Primary School Leavers examination. The secondary programmes available are:

- *Voorbereidend wetenschappelijk onderwijs* (vwo): a six-year programme of study in preparation for university
- *Hoger algemeen voortgezet onderwijs* (havo): a five-year programme of study in preparation for higher education in technical subjects
- *Voorbereidend middelbaar beroepsonderwijs* (vmbo): a four-year programme of general secondary education intended to prepare students to enter the workplace (with or without further training).

The havo and vwo qualifications have a common programme or primary phase for the first three years of secondary school which allows students to delay the final

choice of programme until they are about to enter the second phase of the programmes in their fourth year of secondary school.

The programmes of study and examinations leading to vwo, havo and vmbo qualifications are defined in regulations by the Minister of Education, Culture and Science.

Whilst there are no overall graduation rates available, 39 per cent of the Dutch population have graduated from a general upper secondary education, with 58 per cent completing a vocational programme at the equivalent level (OECD, 2011a).

College Voor Examens (CVE) is an independent administrative body responsible for national examinations in the Netherlands. It provides all the services of a national examination board including publishing the examination syllabus and specifications in accordance with the current regulations. The syllabus sets out in detail the topics which will be examined in the national examinations.

CVE contracts the Central Institute for Test Development (Cito) to develop the assessment materials and provide other services (College Voor Examens, 2012).

Cito was founded by the Dutch government in 1968 as one of the earliest national institutes for education measurement, and became fully privatised in 1999. In addition to developing the test materials used in the secondary havo, vmbo and vwo national examinations, Cito also produce the Primary Leavers Examination (Cito, 2012).

University admissions

University admissions and student grants are managed by the Dienst Uitvoering Onderwijs (DUO), or Learning Implementation Service. Students who have obtained the vwo are eligible to apply to universities to follow academic programmes of study; those with the havo may apply for technical programmes or complete a further year of study in order to qualify for academic programmes.

Some courses have specific requirements and may also have a proportion of places allocated by the institution using their own selection processes. For centrally administered admissions, where the number of eligible applicants exceeds the number of places on a specific course, these are assigned at random.

Single-subject courses of full-time study after students complete the vwo are typically three years for a Bachelor degree. Courses in technical subjects (for students with havo qualifications) are typically two years for an Associate degree and four years for a Bachelor degree (Ministerie van Onderwijs, Cultuur en Wetenschap, 2012b).

The Netherlands has ten universities considered to be amongst the best 200 in the world. These include Eindhoven University of Technology, Leiden University, VU University Amsterdam and Utrecht University (Times Higher Education, 2010).

New Zealand

New Zealand is an island country in the south-western Pacific Ocean with a population of 4.37 million (Statistics New Zealand, 2011).

The Ministry of Education in New Zealand is the central government agency responsible for guiding the education sector to deliver New Zealand's education system. The aim is to equip all children in New Zealand with the knowledge, skills and values to be successful citizens. The New Zealand Qualifications Authority (NZQA) coordinates all qualifications in post-compulsory education and training. It sets and reviews qualification standards, manages national examinations and accredits post-secondary programmes (New Zealand Qualifications Authority, 2012a).

The education system in New Zealand is structured in three levels – early childhood education, schooling, and tertiary education. All school education is free in the state system, as is most early childhood education (New Zealand Ministry of Education, 2012a).

The majority of schools in New Zealand use English as the main language of instruction. Some, however, use *te reo Māori* (the Maori language) as the principal language of instruction. These schools are known as *Kura kappa Māori* (Maori-language immersion schools) and *Wharekura* (secondary schools). Education in these schools is based on Maori culture and values. Most *kura kaupapa* provide education for students from Years 1 to 8, whilst *wharekura* cater for students up to Year 13 (New Zealand Ministry of Education, 2012b).

In New Zealand education is compulsory for students aged between 6 and 16 years, although the majority of students begin school at age 5. Primary school education lasts for eight years and is for students aged 5 to 13. It covers Year 1 to Year 8 and is compulsory. Primary education is offered by primary and intermediate schools.

Secondary education lasts for five years and is for students aged 13 to 18. It covers Year 9 to Year 13. It is compulsory until age 16. Secondary education is offered by secondary schools, high schools and colleges.

Post-compulsory upper secondary education lasts for three years in New Zealand. At this level, students study towards National Certificate of Educational Achievement (NCEA) qualifications. These are composite qualifications made up of credits gained from a wide range of subjects, school curriculum learning areas and other programmes.

There are three levels of NCEA: 1, 2, and 3. Generally students complete level 1 standard subjects in Year 11, level 2 in Year 12 and level 3 in Year 13.

The NCEA system is administered by the NZQA. The NZQA are responsible for managing the secondary school assessment system and quality assuring non-university education providers. They also manage the New Zealand Qualifications Framework (NZQF),

In total 90 per cent of the New Zealand population have completed some form of upper secondary education (77 per cent of those aged 25 years and under). The highest graduation rates are from general programmes (71 per cent), compared with 19 per cent from vocational programmes (OECD, 2011a).

University admissions

There are eight universities in New Zealand, teaching approximately 182,000 students (part- and full-time) and employing around 19,500 staff. Of these providers, the University of Auckland is listed amongst the top 200 universities in the world (Times Higher Education, 2010). The Tertiary Education Commission has responsibility for Higher Education. Approximately 40 per cent of universities' annual income comes from government grants. The remaining income is split evenly between student fees and other sources such as principal research contracts and trading income (Universities New Zealand, 2011a).

The common entrance standard in New Zealand (also known as the University Entrance, or UE), or its equivalent, may be met in a number of ways. The main qualification in New Zealand which meets the common entrance standard is a level 3 NCEA.

There is a range of other qualifications that are also deemed equivalent to the common entrance standard, including the International Baccalaureate, and Cambridge International A levels. Older qualifications that pre-date the NCEA can also be considered (Universities New Zealand, 2011b).

Norway

Norway is a constitutional democracy in northern Europe with a population of 4.9 million (Statistics Norway, 2011).

In Norway, the Ministry of Education and Research has the overall responsibility for all areas of education including pre-school provisions. The Ministry is supported by county governors who form the links between the Ministry of Education and Research and the Norwegian Directorate for Education and Training (an executive subordinate agency for the Ministry) on the one hand, and the education sector in municipalities and counties on the other (OECD, 2007). The municipalities "are responsible for operating and administering primary and lower secondary schools,

whereas the county authorities are responsible for upper secondary education and training" (Norwegian Ministry of Education and Research, 2007).

School education is compulsory between the ages of 6 and 16 (Grades 1 to 10). In total it comprises 19 years, including the non-compulsory kindergarten for 1- to 5-year-olds prior to Grade 1 and three years in senior secondary. A parallel system exists in Sami districts. Here separate curricula for primary and secondary education in Sami has been developed in collaboration with the Sami parliament (the Sameting).

Once students complete their basic education (primary and lower secondary stages), they are entitled to attend upper secondary school (*videregående skole*) between the ages of 16 and 19. The certificate of completion of this phase of education is known as the *Vitnemål fra den Videregående Skole* (Certificate of Upper Secondary Education), although the exact nature of the qualification gained varies depending on the education programme taken. Upper secondary education and training is organised in 12 different education programmes; three programmes for general studies and nine vocational education programmes. Around half the students attend the programmes for general studies, the other half attend the vocational education programmes (Eurypedia, 2011c).

The general studies programme takes three years to complete. If successful students gain the *generell studiekompetanse* (General University Admissions Certification), which qualifies them to access higher education at undergraduate level. The vocational programmes typically comprise two years in school education followed by one year in service training in an enterprise. These programmes mainly lead to a craft or journeyman's certificate, usually after two years in school and a further two years in service training in an enterprise. It is possible for students who have finished their vocational education at Vg1 and Vg2 (the first two years of upper secondary education) to take a year-long supplementary programme for General University Admissions Certification in Vg3 class (Norwegian Ministry of Education and Research, 2012).

A total of 91 per cent of the Norwegian population have completed some form of upper secondary education (78 per cent of those aged 25 years and under). The highest graduation rates are from general programmes (58 per cent), compared with 23 per cent from vocational programmes (OECD, 2011a).

University admissions

The Norwegian Ministry of Education and Research made regulations in 2007 which specify the qualifications necessary for admission to a Norwegian university, specific course requirements and the ranking process which institutions must follow when considering applicants (Norwegian Ministry of Education and Research, 2012b).

The Norwegian Universities and Colleges Admission Service, NUCAS (Samordna opptak) coordinates admission to regular undergraduate studies at all 48 of the universities, university colleges, state colleges and private colleges in Norway.

The NUCAS admission system is primarily for applicants who have successfully completed the general studies programme of the *Vitnemål fra den Videregående Skole* or an appropriate combination of other Norwegian qualifications. NUCAS allocates points for specific courses which have been completed; additional points are added if students meet specific course requirements and also for performance in an interview or other admission test.

Single-subject courses of full-time study are typically three years for a Bachelor degree.

One Norwegian institution (the University of Bergen) is considered to be amongst the best 200 universities in the world (Times Higher Education, 2010).

People's Republic of China

Located in East Asia, the People's Republic of China is the most populous state in the world with a population of 1334.74 million (China Statistics Press, 2010). It consists of four municipalities, five autonomous regions, two Special Administrative Regions (SARs) and over 20 provinces. Education policy and provision is managed by the Ministry of Education (MoE) through local government education committees.

The MoE is actively seeking to develop the provision of education across the People's Republic of China under the long-term education reform and development plan (2010–20). This is a wide-ranging programme which seeks to improve the quality and provision of education across the whole of China (Ministry of Education, 2011) and includes international partnerships; for example the eChina–UK eLearning Programme currently being undertaken at Nottingham University (eChina–UK eLearning Programme, 2012).

School education comprises nine compulsory years, usually between the ages of 6 and 15 (Years 1 to 9) plus the non-compulsory preparatory year prior to Year 1 and upper secondary academic and vocational options.

This upper secondary phase represents three years of post-compulsory education and is for students aged between 15 and 18. Students may participate in the upper secondary phase at general (academic), vocational or technical senior secondary schools. Students are selected from lower secondary schools by way of locally administered entrance examinations.

Once they have completed the upper secondary phase, students may choose to take the *Gāokǎo*, or National Higher Education Entrance Examination. High scores in this examination facilitate entry to university. The total first-time graduation rate from

senior secondary education in China is 65 per cent (OECD, 2011a). At 38 per cent, the graduation rate from general programmes is slightly lower than from vocational programmes (45 per cent).

The National Education Examinations Authority (NEEA) of the People's Republic of China (including the State Office of the Self-taught Higher Education Examinations and the Office of the Self-taught Higher Education Examinations of the Ministry of Education), reports to the Ministry of Education (MoE). It is appointed by the MoE to "exclusively undertake educational examinations and to practise some administrative authority" (National Education Examinations Authority, 2012). The NEEA was founded in 1987. In 1994 it was merged with the State Office of the Self-taught higher education examinations and the Office of the Self-taught higher education examinations of the Ministry of Education (National Education Examination Authority, 2012a).

The NEEA is the awarding organisation for the *Gāokǎo* (or National Higher Education Entrance Examination), which it manages through local examination authorities.

University admissions

Admission depends primarily upon taking the annual *Gāokǎo* administered by the NEEA (National Education Examination Authority, 2012a). Colleges may set different score requirements for different cities and regions. Exceptionally talented students may be excused the examination and recruited directly by university departments.

An Associate degree course is typically two to three years while a Bachelor degree course is four to five years (CUCAS, 2012).

Six of the universities in the People's Republic of China are ranked amongst the best 200 in the world. Of these Peking University, University of Science and Technology of China, and Tsinghua University all rank within the top 60 internationally (Times Higher Education, 2010).

Republic of Ireland

The Republic of Ireland is a sovereign state in north-western Europe with a population of 4.6 million (Central Statistics Office Ireland, 2011).

The Department of Education and Skills has overall responsibility for education in the Republic of Ireland. The department is advised by the National Council for Curriculum and Assessment (NCCA). The NCCA's role is "to lead developments in curriculum and assessment and to support the implementation of changes resulting from this work" (National Council for Curriculum and Assessment, 2007).

The Irish education system is structured into three levels: primary (lasting eight years), secondary (lasting five or six years) and higher education (including

undergraduate and post-graduate degrees, post-secondary courses, and vocational and technical training).

Education is considered a fundamental right under the Irish constitution and is free in most schools (as is undergraduate third level). Full-time education is compulsory from the age of 6 to 15 (Education in Ireland, 2011a).

In the senior cycle of secondary education, students (aged 15–18) may choose one of three Leaving Certificate programmes. The most popular is The Leaving Certificate (Established). Students take at least five subjects including Irish. Access to third-level courses is dependent on the results achieved on this programme. The other two options are The Leaving Certificate Vocational programme (similar to The Leaving Certificate (Established) but with a vocational element) and The Leaving Certificate Applied (a two-year programme with a strong vocational emphasis) (Education in Ireland, 2011b). The State Examination Commission (SEC) acts as the awarding organisation for the Leaving Certificate. It is responsible for the qualification's development, assessment, accreditation and certification (Department of Education and Skills, 2012).

In Ireland, 91 per cent of the population have completed some form of upper secondary education (90 per cent of those aged 25 years and under). The highest graduation rates are from general programmes (68 per cent), compared with 48 per cent from vocational programmes (OECD, 2011a).

University admissions

There are seven universities in Ireland (Education in Ireland, 2011c). Trinity College Dublin and University College Dublin are both ranked amongst the top 200 universities in the world (Times Higher Education, 2010). Applications to these and other higher education institutes in Ireland are managed centrally by the Central Applications Office (CAO) (Central Applications Office, 2011).

A number of qualifications can be used to gain entry to higher education, including the Irish Leaving Certificate Examination, Further Education and Training Awards Council (FETAC)) qualifications and GC(S)E Examinations (England, Wales and Northern Ireland qualifications) (Central Applications Office, 2011).

Students who have taken Leaving Certificate examinations gain points for the results they achieved in their six best subjects. The points are allocated based on the grade that they achieved in these subjects.

The number of points required for entry to any course depends on the number of places and the number of applicants for those places. Entry requirements therefore fluctuate from year to year. In general, a minimum of C3 is required in English, mathematics and Irish (Courses.ie, 2006).

In 2010, the CAO received 78,199 applications to higher education. Of these, 45,623 were accepted (44.5 per cent at universities, 55.5 per cent at other higher education institutes) (Central Applications Office, 2010).

In 2012 a four-year pilot scheme will begin. The seven universities, Dublin Institute of Technology and the Royal College of Surgeons in Ireland will allocate extra bonus points for Higher level mathematics.

Republic of Korea

The Republic of Korea (also known as South Korea) occupies the southern half of the Korean peninsula situated on the Pacific coast of East Asia. It has a population of 48 million (UNESCO Institute of Statistics, 2012).

The national Ministry of Education, Science and Technology (MEST) is responsible for school education, vocational education and lifelong learning. The Ministry delegates a number of its functions to a local level. Many budgetary and administrative decisions in particular are passed to the seven municipal and nine provincial district offices of education, known as Municipal and Provincial Education Authorities (MPEAs) and Metropolitan and Provincial Offices of Education (MPOEs) (International Review of Curriculum and Assessment Frameworks Internet Archive, 2010).

Education in the Republic of Korea is compulsory for nine years from age 6 to 15. Middle school became free and compulsory across the country in 1985.

Post-compulsory upper secondary education is taken by students aged 15–18 years. Most students take the general academic route (including the specialist high schools for gifted students). There is also a vocational route leading to a Vocational High School Diploma.

There is a mixture of assessment types used during secondary (high school) education:

- entrance examinations
- SATs (annual national Scholastic Achievement Tests)
- *Su-neung* (College Scholastic Ability Tests, or CSATS) in the main areas of Korean language, mathematics, foreign language (English), science, social studies and second foreign languages / Chinese characters and classics; all are optional (students select subjects required by the colleges they wish to attend)
- continuous teacher assessment.

According to OECD statistics, the total first-time graduation rate from upper secondary education in the Republic of Korea is 89 per cent. The graduation rate from general programmes (66 per cent) is higher than for vocational programmes (23 per cent) in the Republic of Korea (OECD, 2011a).

The main entrance qualification for higher education is the College Scholastic Ability Test (CSAT). This is designed to measure the student's scholastic ability required for college education. The CSATs are developed and administered by the Korea Institute for Curriculum and Evaluation (KICE) (Korea Institute for Curriculum and Evaluation, 2012a).

KICE is a government-funded educational research institute, established in 1998. Its educational research activities include research into curriculum and assessment, improvement of teaching and learning methods and the development of textbooks (Korea Institute for Curriculum and Evaluation, 2012a).

University admissions

There are seven types of higher education institutions in the Republic of Korea. These are: colleges and universities, industrial universities, universities of education, junior colleges, broadcast and correspondence universities, technical colleges, and other miscellaneous institutions. Courses typically last for four to six years.

There is no central office for university applications; students apply directly to the university they wish to attend (Ministry of Education, Science and Technology, 2012). Universities judge applicants based on a range of factors including: students' high school records, their CSATs results and their involvement in any extra-curricular activities. Some universities also use essays, interviews and practical skills tests to screen students. Originally universities were mandated to give more than 40 per cent weighting to high school records when considering students for entry. This is no longer compulsory and universities may now vary the importance they attach to any of their entry criteria (International Review of Curriculum and Assessment Frameworks Internet Archive, 2008).

Four of the universities in the Republic of Korea (Seoul National University, Korea Advanced Institute of Science and Technology, Yonsei University and Pohang University of Science and Technology) currently rank amongst the world's top 200 universities (Times Higher Education, 2010).

United States of America (New York State and the ACT)

The USA is a federal republic with a population of 313 million (US Census Bureau, Population Division, 2011). The country is situated mostly in central North America and consists of 51 administrative divisions (50 states and one district) with 14 dependent areas (Central Intelligence Agency, 2011). The US Department of Education is the agency of the federal government that "establishes policy for,

administers and coordinates most federal assistance to education" (US Department of Education, 2010). The responsibility for education policy and provision is devolved through state legislatures to the 14,000 school districts and their 125,000 public and private schools.

Each state operates an independent education system which can include specialist and technical schooling as well as charter and private schools. Students may also complete a college readiness test, which is not state specific, in their final year of secondary school to assist in gaining a place in further education. The ages of compulsory school education vary between states but students usually start Grade 1 at age 6 and must stay in school until the age of 16 or older. However, there are a number of initiatives to coordinate and improve educational standards across the whole country.

According to OECD statistics, 76 per cent of the US population have completed some form of upper secondary education (76 per cent of those aged 25 years and under) (OECD, 2011a). President Obama has established this as a key area for progress, setting a goal that, by 2020, the USA will have the highest proportion of college graduates in the world.

In April 2009, governors and state commissioners from across the USA signed up to a state-led process to develop a common core of state standards in English language arts (ELA) and mathematics from Kindergarten to Grade 12. One of the main goals was to develop a "common core of standards that are internationally benchmarked, aligned with work and post-secondary education expectations, and inclusive of the higher order skills that students need" (New York State Education Department, 2011a).

The Common Core State Standards (CCSS) for mathematics and English language arts and literacy in history / social studies, science and technical subjects were published in June 2010. States began to implement them immediately, many as part of their commitment to the federal "Race to the Top" reforms (National Governors Association, 2009). In this study we have looked at assessment materials from New York State. New York State is the third largest by population, with 19.5 million residents (US Census Bureau, Population Division, 2011).

The Board of Regents is responsible for the supervision of education in New York State, including presiding over the University of the State of New York and the New York State Education Department. The Board comprises 17 members elected by the state legislature for five-year terms: one from each of the State's 13 judicial districts and four members who serve at large.

It is the school districts which are responsible for developing curricula. They must do this based on the New York State learning standards. These set out what all students

should know and be able to do as a result of skilled instruction. Within each of the state's school districts, young people from the age of 6 to 16 must attend full-time education. The Regents examinations are the end of course examinations in New York State and are aligned with New York State learning standards. These examinations may be taken by students from 8th to 12th Grade depending on their progress through the course. If students obtain passing scores in Regents examinations in English, mathematics and social studies, they are awarded the Regents Diploma.

University admissions

The USA does not have a centralised body responsible for administering admissions to tertiary education. Institutions act independently to select students and may use interviews and admissions testing. There are over 3,800 institutions offering two-year associate degrees or certificates or four-year Bachelor degrees of which almost 1,700 accept all applicants who graduated from high school (primarily on to two-year courses). Of these institutions, 72 are listed as being amongst the top 200 universities in the world. Indeed, the top five in this ranking are all US universities: Harvard University, California Institute of Technology, Massachusetts Institute of Technology, Stanford University and Princeton University (Times Higher Education, 2010).

In addition to graduating from high school by fulfilling their home state's requirements for the completion of senior secondary education, a student can also choose to take college readiness tests, for example the SAT (College Board, 2010a) and the ACT (ACT, 2010b) in support of their applications. Some schools also offer recognised study programmes such as the College Board's Advanced Placement (AP) programme, which includes nationally recognised subject assessments (College Board, 2010b). Almost 1,800 institutions offer credit for AP because the course content overlaps with their first-year course content.

Over 3 million students graduated from high school in the USA in 2009 (Stillwell et al., 2011).

University of Cambridge International Examinations

University of Cambridge International Examinations (CIE) is part of the not-for-profit organisation Cambridge Assessment. Cambridge Assessment was formed in 1858 by the University of Cambridge (University of Cambridge International Examinations, 2012a). It is now the world's largest provider of international education programmes and qualification for 5–19 year olds (University of Cambridge International Examinations, 2012d).

CIE provides a range of programmes and qualifications for primary, secondary and pre-university schooling as well as the Cambridge Professional Development qualifications for teachers.

Across the world, more than 9,000 schools offer CIE programmes and qualifications. Programmes are available in 160 countries across the Americas, Asia Pacific, Europe, the Middle East and North Africa, South Asia and Southern Africa.

At upper secondary level, CIE provides AS and A level qualifications. These are taken in over 125 countries worldwide. In some of these countries (such as Singapore), CIE examinations are the main state qualification for students in secondary education (University of Cambridge International Examinations, 2012b).

University admissions

CIE qualifications are recognised by universities in many different parts of the world (University of Cambridge International Examinations, 2012c). For example, UCAS, which manages applications for courses at universities within the UK, accepts both the Cambridge International AS and A levels, and the Cambridge Pre-U in support of applications (UCAS, 2012a).

3 Descriptions of qualifications and assessments

Within the education systems outlined above this study focuses upon senior secondary assessments, in particular those in which a satisfactory result is accepted in support of an application for a place on a degree course at a university-level institution.

The qualifications and assessments in this study are either specifically university entrance examinations or have a more general purpose in recognising the completion of a course of upper secondary study. Those with the more general purpose can be divided further between specific stand-alone qualifications and those which form part of a composite certificate of achievement (such as a diploma). Table 2 in the Full Report Table Supplement summarises some key features from the qualifications and assessments included in this study.

There are differences in the number of subjects studied as part of each qualification or assessment at senior secondary level. A level students typically study the fewest subjects at around three to four. In contrast, students in Denmark, Finland and New York State study at least 10 subjects. Whilst the guided learning hours for each qualification are not available in a comparable format, it is evident that as the number of subjects studied increases, the time spent on each is necessarily reduced.

Of the qualifications included in this study, A levels in England, the New Zealand NCEA and the two CIE qualifications are the only assessments for which there are no compulsory subjects. The number of compulsory subjects varies widely from one in New South Wales and the Republic of Ireland (English and Irish respectively) to 13 in Denmark. An indication of this range is demonstrated in Table B.

Typical number of subjects studied	Qualifications and examinations	Number of compulsory subjects	Compulsory mathematics element?
3 or 4	England: A levels	0	×
3 or 4	Cambridge International A levels	0	×
4	USA: the ACT*	4	✓
5	Australia: New South Wales HSC	1	×
5	Hong Kong: HKALE (outgoing qualification)	2	×
5	Republic of Korea: CSAT	5	✓
5	Cambridge International Pre-U Diploma[+#]	2	×
5 plus	Republic of Ireland: Leaving Certificate (Established)	1	×
5 or 6	New Zealand NCEA Level 3	0	×
6	People's Republic of China: *Gāokǎo**	3	✓
7	Canada: Alberta Diploma	6	✓
7	IB Diploma[#]	6^	✓
8	Hong Kong: HKDSE (incoming qualification)	4	✓
8 or 9	Netherlands: havo	7	×
9 or 10	Netherlands: vwo	9	✓
9 or 10	Norway: *Vitnemål*	9	✓
9 to 12	France: *baccalauréat général*[#]	9	✓
10	Finland: Matriculation Examination	4	✓
10	USA: New York State Regents Diploma	10	✓
13 plus	Denmark: STX	13	✓

[#] number of compulsory subjects include an independent research project or portfolio submission which may cross over traditional 'subject' boundaries.

* assessment is independent of the school syllabus

+ students can gain Cambridge International Pre-U qualifications on a subject by subject basis, however, to gain the Cambridge International Pre-U Diploma they must take three subjects along with a mandatory independent research report and global perspectives portfolio.

^ This total excludes the theory of knowledge and extended essay.

Table B: Examples of the balance of compulsory subjects and total subject areas covered by qualifications included in this study

There are differences in the level to which the compulsory language must be studied and there is a wide range of approaches from the functional use of English in Hong Kong through to the more comprehensive language acquisition in the IB Diploma which includes the study of literature and culture.

In several education systems both teaching and assessment are offered in more than one language, recognising the cultural heritage of the country's population. The curriculum in New Zealand has been developed jointly in English and *te reo Māori* (the Maori language) to meet the needs of all students. Similarly in Finland education is provided in the official languages of Finnish and Swedish, and the significant minority language of the Sami peoples. Finland also recognises mother tongue languages including Roma and Finnish sign language.

In all systems with more than two compulsory subjects, for example, Alberta, Finland and France, mathematics is compulsory. Where it does not feature in the senior secondary assessments, students are expected to have studied mathematics in lower secondary school.

The way that students gain their qualification, or are graded as part of their studies, varies widely. For example, in New York State and New Zealand there is a threshold of a certain number of "credits" that have to be achieved before students become eligible to gain the qualification.

Beyond the distinction of gaining or not gaining the qualification, there are different ways that student performance is described, or graded. These take essentially three forms: those based on performance descriptors (for example A levels and both the HKALE and HKDSE in Hong Kong), those based on a percentage of marks achieved in the qualification (for example the Republic of Ireland Leaving Certificate), and those based on norm referencing (for example the Finland Matriculation Examination and Republic of Korea CSAT). Grades are usually described in a numerical scale, and there is a wide range of bands of performance, from six in A levels and the HSC in New South Wales, to 13 in the Republic of Ireland, as Table C below demonstrates.

Education system: qualification	Number of grades (excluding any for no grade given)	How they are described
Australia: New South Wales HSC	6	Performance bands: 1−6 with 6 being the highest Band 2 is the minimum standard expected.
England: A levels	6	Grades: A*−E with A* being the highest Below E grade is a fail.
Norway: *Vitnemål*	6	Grades: 1−6 with 6 being the highest A grade of 2 is considered a pass.
Republic of Korea: CSAT	9	Stanine scores: 1−9 with 1 being the highest
Republic of Ireland: Leaving Certificate (Established)	13	Grades: A1−F with A1 being the highest

Table C: Examples of grading structures of some of the qualifications analysed in this study

In the Alberta Diploma, grades are not used. Instead, results are displayed as a percentage, and 50 per cent is considered a pass. A student gaining a percentage lower than this would not receive credit towards their diploma.

None of the qualifications we looked at included a ranking of a student against all others. However, the scores provided by examinations such as the People's Republic of China *Gāokǎo*, the Republic of Korea CSAT and the USA ACT play a similar role. The specific purpose of the *Gāokǎo*, the CSAT and the ACT is to provide a score for students to inform their selection for degree-level courses. The *Gāokǎo* and the CSAT are compulsory for any students applying to universities in the People's Republic of China and the Republic of Korea respectively. However many higher education institutions do consider each student's high school achievement record in addition to their test score. These two assessments are unlike all others considered by this study in that the results are only valid for university applications in the current year. Students who defer their applications or wish to delay taking up a place on a degree course have to retake the assessments.

The ACT is one of a number of commercially provided tests accepted by universities in support of student applications. The ACT specifically assesses college readiness in terms of the student's ability to process information and solve problems rather than testing subject knowledge. The remainder of the assessments in this study all include tests of subject knowledge.

The *Gāokǎo* and the ACT operate separately from the programmes of study provided by schools. The ACT organisation carries out considerable research to ensure that the subject content of its assessments will reflect the taught syllabus across all the United States. In contrast, the National Education Examinations Authority (NEEA) produces syllabus documents for the *Gāokǎo,* defining the specific subject content that the tests will cover.

The other university entrance qualification included in the study is the Finland Matriculation Examination. However this assessment has evolved from its origins as an entrance examination for Helsinki University to providing the final assessment of all Finnish senior secondary school students in the academic or general studies programme. Therefore, although the Finnish Matriculation Examination Board is independent from the Ministry of Education and Culture the examination is designed to assess the school syllabus content.

In addition to Finland, senior secondary education in Denmark, England, France, the Netherlands, Norway and the Republic of Ireland provides distinct programmes of study for academic or general studies and for vocational studies. The assessments or qualifications included in this study from these countries are those which are recognised for university admission, generally those with academic content. This includes the Netherlands havo, described as a vocational study programme, but actually designed to prepare students for degree-level studies in technical and applied subjects.

Other distinctly academic qualifications included in this study are the HKALE, the IB Diploma, Cambridge International A levels and the Cambridge Pre-U Diploma. The systems which offer these assessments do not provide equivalent vocational programmes of study and although these are not exclusively university entrance examinations they do set out to prepare students for further study at degree level.

In other education systems, the completion of senior secondary school is recognised by a certificate or diploma which records student achievement across a range of possible subjects including both academic and applied or vocational courses. For example in New South Wales a student achieves their HSC by passing HSC courses in five subjects including English, but this can include applied or vocational courses.

The new HKDSE qualification, which will be completed by the first cohort of students in 2012, includes a considerable range of applied learning subjects, while in New Zealand students can complete courses at different levels within their NCEA although they do need sufficient credits at NCEA Level 3 to apply for degree-level studies.

To obtain their diploma in Alberta and New York State students must pass examinations in a specific selection of academic subjects but both education systems

do include vocational courses, and these contribute to the school-assessed element of high school graduation.

Alberta and New York State are also distinct in their provision of additional study resources for students intending to apply for degree-level studies. Both education systems actively encourage those who are academically capable to complete their diploma ahead of the expected age and offer college preparation courses leading to qualifications which provide additional support to applications for degree-level studies.

In all cases except for the Netherlands, senior secondary education is not compulsory. Almost all assessments are usually taken after 12 years of schooling, although in England and Norway it is 13 years and in Alberta up to 14 years. Additionally in the People's Republic of China and the Republic of Korea students may complete senior school and then follow extra study courses before taking the assessments. Most students tackle their senior secondary assessments at about 18 years old. Havo students are the youngest at about 17 and those in Finland and Norway are the oldest, at about 19.

Although students complete their studies at similar ages there are some differences in the length of the programmes they follow, as illustrated in Table D.

Expected years of study	Education system: qualification
2	Australia: New South Wales HSC England: A levels France: *baccalauréat général* Hong Kong: HKALE (outgoing qualification) IB Diploma Republic of Ireland: Leaving Certificate (Established) Cambridge International A levels Cambridge Pre-U
3	Denmark: STX Finland: Matriculation Examination Hong Kong: HKDSE (incoming qualification) New Zealand: NCEA Levels 1, 2 and 3 Norway: *Vitnemål*
3–5	Canada: Alberta Diploma
4	USA: New York State Regents Diploma
5	Netherlands: havo
6	Netherlands: vwo

Table D: Usual time taken to complete qualifications included in this study

Students in the Netherlands make a commitment to their programme of study at the beginning of their secondary education (12 years of age) while under other systems this choice is taken later.

There is also a variety of assessment models in use amongst the qualifications and assessments included in this study. These relate to both the style and nature of the examination, and the timing of the assessments. In New York State, for example, the Regent Examinations are designed to be taken as students progress through their four-year senior high school study programme. The current A level programme in England is designed so that the assessments can take place at intervals through the two-year course, or all at the end.

The *Gāokǎo* and the ACT operate separately from the programmes of study provided by schools. The ACT organisation carries out research to ensure that the subject content of its assessments will reflect the taught syllabus across all the United States. In contrast, the National Education Examinations Authority produces syllabus documents for the *Gāokǎo,* defining the specific subject content which the tests will cover and students expect to take additional courses to prepare for the examination.

3.1 Qualification profiles

In this section we outline some of the key features of the qualifications included in this study. These include a brief outline of the profile of students who undertake the qualification, the structure of the qualification and how students are assessed. These profiles are supported by information contained in Table 2 in the Full Report Table Supplement.

Australia – New South Wales High School Certificate

Total students: 68,409; achieved: 63,518 (Board of Studies NSW, 2011)

The Higher School Certificate (HSC) is awarded to students who successfully complete senior high school level studies (Years 11 and 12 or equivalent). It is developed, managed and awarded by the Board of Studies NSW. Typically, the qualification is studied over two years by students aged 17–19.

To be eligible to study for the HSC, students must first complete the NSW School Certificate. This is awarded by the Board of Studies NSW to eligible students at the end of Year 10.

All courses in the HSC have a unit value. Most courses are worth two units. In order to gain an HSC, students “must have completed a minimum of 12 units of Preliminary courses and ten units of HSC courses. Students must satisfactorily complete the Preliminary course (usually studied during Year 11) before they are eligible to commence the corresponding HSC course (usually studied during Year 12)” (Board of Studies NSW, 2012c).

Students can study a great number of possible courses in a wide range of subject areas. English is the only compulsory component of the HSC.

There are two main types of course: Board Developed and Board Endorsed courses (Board of Studies NSW, 2012b).

Board Developed courses are set and externally examined by the Board of Studies including courses in the areas of English, mathematics, science, technology, creative arts, personal development, health and physical education, human society and its environment, languages and vocational education and training (VET) curriculum frameworks. The raw marks from these courses may contribute to the calculation of an Australian Tertiary Admission Rank (ATAR).

Board Endorsed courses include courses that may have been developed by schools, by the vocational educational and training provider NSW Technical and Further Education Commission (TAFE NSW), or by universities. They contribute to the HSC but do not contribute to the calculation of the ATAR (Board of Studies NSW 2012b).

The HSC does not report a single, overall score. Instead, on completion of the required courses students are issued with their HSC Record of Achievement which includes the following information for each course taken:

- **Assessment mark:** Students must complete a number of school-based assessment tasks for many of the HSC courses. These may include “tests, written or oral assignments, practical activities, fieldwork and projects” (Board of Studies NSW, 2012d). Based on the outcomes of these tasks, schools submit an HSC assessment mark for each student in every course. Following a moderation process, the Board converts all the students’ individual raw scores on to the 0 to 100 performance level scales (Board of Studies NSW, 2012d).

- **Examination mark:** this mark shows a student’s performance in the Board’s HSC examination for that course. The examination typically consists of a written paper. For some courses it may also include oral examinations and practical examinations. Achievement is assessed and reported against set performance standards and a judgement panel is appointed to identify the cut-off point for each performance level. This is then used to convert all the students’ individual raw scores on to the 0 to 100 performance level scales. The judgement process is designed to maintain consistent standards of achievement from year to year (Board of Studies NSW, 2012d).

- **HSC mark:** the HSC mark is a straightforward 50:50 combination of a student’s converted marks for the external examination and school-based assessment for each course.

- **Performance band:** a student's HSC mark for each course will fall within one of six performance bands, where the highest achievement is Band 6 (90–100). The minimum standard expected is Band 2 (50–60 marks). Band 1 is given for HSC marks below 50.

Canada – Alberta Diploma

Total students: 45,286; achieved: 30,689 (Government of Alberta, 2010b)

The Alberta Diploma is the main qualification awarded to students completing their high school education in Alberta. It is developed and administered by the Government of Alberta. In order to gain the Alberta Diploma, students take part in the Grade 12 Diploma Examinations programme. This takes place at the end of the three-year course when students are typically aged 17–18 years. Established in 1984, the Diploma Examinations programme has three main purposes:

> - to certify the level of individual student achievement in selected Grade 12 courses
> - to ensure that province-wide standards of achievement are maintained
> - to report individual and group results"
>
> (Government of Alberta, 2011a)

To receive the Alberta Diploma a student must achieve the minimum requirement of 100 credits including:

- one English language arts course at 30 level (5 credits), and
- one social studies course at 30 level (5 credits), and
- one mathematics course at 20 level (5 credits), and
- one science course at 20 level, or a specific combination of 10 level courses (5 credits), and
- physical education at 10 level (3 credits), and
- career and life management (3 credits).

Students can gain credits from a range courses taught under the Alberta Education curriculum or otherwise. These include special projects, the Registered Apprenticeship Programme, work experience courses, Green Certificate specialisation courses, Advanced level Career and Technology Studies (CTS) and other locally developed / acquired / authorised courses. High school courses within Alberta schools are generally available at three levels (10, 20 and 30) and are usually worth 5 credits each. 30 level is the most demanding and the 30 level courses, in eight subjects (applied mathematics, biology, chemistry, English language arts,

physics, pure mathematics, science and social sciences) lead to the Diploma examinations (Government of Alberta, 2011b).

The Alberta Diploma does not report a single overall score. Instead, on completion of the required courses students are issued with their High School Diploma supported by the official transcript which includes the school mark, examination mark and final mark for each course. These are as follows:

- School mark: school-based assessment is expected to measure student achievement against the full range of outcomes specified for the course resulting in a school-awarded mark. The individual student school marks are reported by schools to Education Alberta at the end of every course. The school mark is reported as a percentage.

- Examination mark: the examination mark for each course (also given as a percentage) shows the student's performance in the Alberta Diploma examination for that course. Examinations are available for 30 level courses in applied mathematics, biology, chemistry, English language arts, physics, science, pure mathematics and social science. They consist of a minimum of 50 per cent machine-scored / multiple-choice questions. The remainder of the paper may be machine scored, or consist of short, long or essay-type answers dependent upon the subject. Within every examination around 20 per cent of the machine-scored items are anchor items[11] and the cohort performance on these items is used to inform the equating process used by Education Alberta to adjust all the students' total scores to the same metric or standard found in the baseline examination (Government of Alberta, 2008).

- Final mark: the final mark is generally a straightforward 50:50 combination of a student's school mark and examination mark, although alternative arrangements exist for students outside of the normal school-based system.

- Performance standards: to receive the course credit (pass the course) or to receive the Alberta Diploma a student must obtain a final mark of 50 per cent or more. Students who score 50–79 per cent have reached an Acceptable Standard as defined for the course, students who score 80 per cent or more have reached the Standard of Excellence.

Higher education institutions within Alberta typically quote a minimum average mark of 60 per cent across the Diploma for admission to undergraduate courses. The

[11] An anchor item is an item which is included in two or more tests. Anchor items have known characteristics, and form one section of a new version of a test in order to provide information about that test and the candidates who have taken it. This enables the calibration of a new test to a measurement scale.

University of Alberta quotes a minimum of 70 per cent with higher scores for specific courses (Government of Alberta, 2012b).

Denmark – *Studentereksamen* (STX)

Total candidates: 51,178; achieved: 35,897 (Statistics Denmark, 2011)

The Danish *Gymnasium* (senior secondary school) offers a three-year general academically-oriented upper secondary programme leading to the upper secondary school examination (the *Studentereksamen*, or STX). Successful completion of the STX qualifies students for access to university education. Typically, students start this programme at the age of 16 and complete it at the age of 19. In order to qualify for entry to the first year of the *Gymnasium*, students must complete nine years of Danish basic education and must have passed the compulsory final examination (Ministry of Children and Education, 2012i).

The STX begins with a six-month general or foundation programme during which students agree their course combinations and learn general study skills alongside academic subjects. After this, each student chooses a specialised study programme to take alongside the compulsory subjects (Ministry of Children and Education, 2012i).

The Ministry of Children and Education draws up curricula for subjects and multi-subject courses and all subjects are placed in a system of levels, C, B and A, where a level A course covers a subject with the greatest scope and depth.

The compulsory subjects and levels within the STX are: Danish A, English B, second foreign language B or A, history A, classical studies C, physics C, physical education (PE) C, an artistic subject C, mathematics C, religion C, social science C, and in addition at least two of the subjects biology, chemistry and natural geography at C-level.

In addition to the compulsory subjects, students select a specialised study programme and electives, and take part in a specialised study project in the third year within two or three subjects of their choice. The number of different programmes, as well as the specific content, varies from school to school (Ministry of Children and Education, 2012i). In addition to this, each student selects a number of elective subjects. The number varies according to the study field subjects taken by the student (Ministry of Children and Education, 2012f).

The grading standards for course work and the final examinations are the same for both programmes. There is an expectation that students will study independently for around 25 per cent of the courses and some learning will be structured across the curriculum rather than by individual subjects.

The final overall STX award is calculated as a weighted average of the course marks which reflects the level and number of courses studied. The method of reporting the outcome is changing but achievement continues to be recognised on a seven-point scale where the third point or grade is considered to be a pass.

The overall mark is calculated as a combination of a student's school marks for work completed during the courses and for internal assessments, plus the final examinations administered by the Ministry; these may be for all students or for a particular sample to support national moderation (Ministry of Children and Education, 2011b).

Finally, it is usual practice in Danish schools for students to have access to reference materials during their examinations. In addition to testing subject knowledge the assessments are also intended to test research abilities, data handling and analytical skills. As a development of this Denmark is running a pilot study in which students can use their own computers to access the internet during examinations (Ministry of Children and Education, 2012j).

England – A levels

782,584 subject entries; approximately 250,000 students (Department for Education, 2011d)

Advanced Level General Certificates of Education (A levels) are "usually taken by 16- to 18-year-olds in schools and colleges across the country, but they are available to anyone who would like to gain a qualification in a subject in which they are interested" (Ofqual, 2009). A levels are intended to be studied over a two-year period and are the primary pre-university qualification in England. In many cases, students need to have gained at least five GCSEs at grades A*–C in order to study A levels.

A levels are available in over 45 subjects and can be studied alongside other qualifications. There is no compulsory subject element – A levels can be taken in any combination desired to reflect the interests (or intended progression) of the student. It is accepted that a typical A level student will take three or four A levels at the upper secondary phase.

Schools, colleges and individuals can currently choose between five qualifications providers, or awarding organisations, which we allow to offer A levels: the Assessment and Qualifications Alliance (AQA), the Council for the Curriculum, Examinations and Assessments (CCEA), Edexcel, Oxford, Cambridge and RSA Examinations (OCR), and the Welsh Joint Education Committee (WJEC). All five organisations are members of the Joint Council for Qualifications (JCQ).

An A level is made up of both AS (advanced subsidiary) and A2 units. In the first year (usually Year 12), students can normally choose to study up to four A level subjects

and sit AS level examinations in these subjects. After the first year of study students can choose (for each subject) to:

- take an AS level only and gain a recognised qualification (an AS level is half the size of a full A level course), or
- continue with the course for a second year studying the A2 units and go for the full A level.

Like other regulated qualifications, AS and A levels have clear guidelines (or criteria) setting out "how the qualification should be set up, what students need to learn and what skills they need to develop" (Ofqual, 2009). All awarding organisations must make sure that the syllabus that they offer in each subject meets these criteria before it can be offered to students.

Assessment arrangements differ between subjects, but all include some form of externally set and marked examinations, usually sat at the end of each school year. Overall scores are subject to quality assurance processes to ensure consistent rewarding of all students' achievements within cohorts and over time. This includes individual awarding organisation internal processes, JCQ activities and our regulatory processes.

The A level is a graded qualification. The passing grades are A*, A, B, C, D and E. The A* grade was introduced in September 2008 for higher education entry in 2010, and is awarded to students who achieve an A in their overall A level, with a score of at least 90 per cent at A2. In order to set the grade boundaries each year, awarding organisations consider "examination papers from previous years and papers from the current year, as well as expert judgement and technical and statistical information" (Ofqual, 2009).

Finland – *Ylioppilastutkinto* or *Studentexamen* (Matriculation Examination)

Total students: 37,315; achieved: 32,324 (Statistics Finland, 2010b)

General upper secondary education consists of a three-year course ending in the Matriculation Examination. Courses are typically taken by students from age 16 to 19 years. In order to enter general upper secondary education, students must have a school leaving certificate of basic education. Applications to general and vocational education are made via a joint application system. In situations where applicant numbers exceed the intake, selection is made based on a student's school report (Ministry of Education and Culture, 2012a).

General upper secondary education is primarily provided by local authorities. Of the 435 upper secondary schools in Finland, the majority are run by local authorities (Ministry of Education and Culture, 2012b). Some of these upper secondary schools may specialise in certain subjects, such as sports, art or music.

The Matriculation Examination was initially conceived as the entrance examination for Helsinki University. It was first offered to students in 1852. Nowadays, the purpose of the examination is to “discover whether students have assimilated the knowledge and skills required by the curriculum for the upper secondary school” (Finnish Matriculation Examination Board, 2007). Passing the Matriculation Examination entitles the student to continue on to undergraduate study at university.

The Matriculation Examination Board (Ylioppilastutkintolautakunta) is responsible for designing, administering and delivering the Matriculation Examination. The Board develops guidelines on the contents, the arrangements and the assessment of the tests. The Matriculation Examination Board is led by a board made up of members which represent the various subjects covered by the Matriculation Examination. These board members are nominated by the Ministry of Education and Culture on the suggestion of universities, institutions of higher learning and the National Board of Education. About a further 330 associate members assist with preparing and marking the Matriculation Examination (Matriculation Examination Board, 2007).

Entrants take a minimum of four tests (including at least one for an advanced course) as follows:

- mother tongue test (usually Finnish, Swedish, Sami or sign language)
- three from:
  - second national language
  - foreign language
  - mathematics
  - one from the general studies suite, which includes some cross-subject questions, for example: evangelical Lutheran religion, orthodox religion, ethics, philosophy, psychology, history, social studies, physics, chemistry, biology, geography, and health education.

The student may choose to take additional tests, but only one test per subject is allowed (Finnish Matriculation Examination Board, 2007). Tests are tiered (that is, organised by two different levels of difficulty) and include both written and oral examinations.

The Matriculation Examination Certificate shows the compulsory and the optional tests passed, together with their levels and grades. The grade boundaries are set with the intention of maintaining the standard or value of the grades from year to year. There are seven grades from *Laudatur*, or L (outstanding), to *Improbatur*, or I (below satisfactory). It is generally anticipated that approximately the following

proportions of students will achieve each grade: L = 5 per cent, E = 15 per cent, M = 20 per cent, C = 24 per cent, B = 20 per cent, A = 11 per cent, I = 5 per cent (Finnish National Board of Education, 2011).

France – *baccalauréat général*

Total students: 328,467 (Ministère Éducation Nationale Jeunesse vie Associative, 2011b)

French students can chose to take one of three types of *baccalauréat;* a general academic *baccalauréat (baccalauréat général)*, or specialist technical (*baccalauréat technologique*) or professional baccalaureates (*baccalauréat professionnel*), which are more vocational.

Within the *baccalauréat général* a student can follow three *séries* (streams). These include the *série scientifique* (S), *série économique et sociale* (ES) and *série littéraire* (L) – sciences, economics and social sciences, and literature respectively.

All of these streams are designed to take three years to complete and are typically taken by students aged 15–18. Within each, students study a minimum of nine subjects (if they select a compulsory subject as their speciality) but up to 12 subjects leading to national external examinations. They also work in small groups to produce their *travaux personnels encadrés* (TPE), an independent project expected to cross over between two or more subjects (Eduscol, 2011).

Depending on the specific stream of *baccalauréat général* being followed, the final assessments include written examination papers, practical tests and, potentially, oral tests, depending on the subject. These final assessments are taken during the month of June in third year (*terminale*) of the *baccalauréat général*. Tests taken during continuous assessment count towards the final score in each subject, and account is also taken of student performance during the course.

Each subject assessment is scored out of 20.

The overall *baccalauréat* score is calculated using subject coefficients to produce a weighted average of the individual examination scores with optional subjects included only if the student achieves more than ten points. The overall grade is reported out of 20, again with a score of ten considered as a minimum pass.

If a student scores between 8 and 10 points for their *baccalauréat général* they have the option to sit for the *épreuve de rattrapage* which is a supplemental oral examination in two subjects of the student's choice. If they are successful then the overall weighted grade is raised to a 10 and a *baccalauréat général* qualification is granted.

Students who pass the *baccalauréat général* continue as follows (Ministère Éducation Nationale Jeunesse vie Associative, 2011c):

	Sciences (S)	**Economics and social sciences (ES)**	**Literature (L)**
preparation for the *Grande École*	20%	6%	6%
university	54%	67%	70%
institutes of technology	20%	22.5%	13%
other	6%	4.5%	11%

Hong Kong Advanced Level Examination (HKALE)

Total students: 39,774 (Hong Kong Examinations and Assessment Authority, 2012b)

The HKALE is a legacy qualification in Hong Kong, modelled strongly on the English A level, which acts as the university entrance qualification. It will be replaced by the Hong Kong Diploma of Secondary Education (HKDSE) from 2012 and the last HKALE will be held in 2013, for private students only. Responsibility for both the HKALE and HKDSE lies with the Hong Kong Examinations and Assessment Authority (HKEAA).

The HKALE is typically taken by a student at around age 19 near the end of their two-year sixth form courses (Year S7), although in 2010 over 22 per cent were private students and almost 25 per cent were resits (Hong Kong Examinations and Assessment Authority, 2011).

There are 17 A level and 18 AS level subjects in the HKALE. AS level subjects are taught in half the number of periods required for A level subjects, but they require the same level of intellectual rigour. Most students take five subjects in the HKALE. With a few exceptions (AS Chinese Language and Culture, AS Use of English and other language-related subjects) all subjects can be taken in either language. Marking and grading standards are the same in either language, and the language medium is not recorded on the results certificates.

The HKALE is a graded qualification with six grades A–F (where grade A is the highest and F is the lowest). Below grade F, results are designated as “unclassified” (UNCL). According to the HKEAA, grade E of an A level or AS level result is

equivalent to grade E in their English A level counterparts (Hong Kong Examinations and Assessment Authority, 2011).

The grading of large-entry subjects is calculated using a control group which makes up about one third of schools. These schools must all have a certain level of performance along with relatively stable examination results over the past few years. The main assumption of the control-group approach is that the performance of these stable control-group schools, taken as a whole, should provide a reasonable norm for setting grading policies. This allows the HKEAA to maintain standards over time even accounting for changes in the demand of the examination or the content of the examination syllabus.

Once the grade boundaries (or cut scores) have been determined, they are applied to the whole candidature regardless of the district where the students take the examination, the schools they come from, or whether they are private students.

To maintain the grading standards of HKALE, Cambridge Assessment assures the grading standards of different HKALE subjects every year (Hong Kong Examinations and Assessment Authority, 2012c).

In 2010 just over 47 per cent of students achieved results which satisfied the general entrance requirements for first degree courses in tertiary institutions (Hong Kong Examinations and Assessment Authority, 2012b).

Hong Kong Diploma of Secondary Education (HKDSE)

Following the recent reforms, all students who entered Secondary Year 1 in September 2006 will sit the first HKDSE examination in 2012, after completing six years of secondary education. Unlike the HKALE, the HKDSE is therefore aimed at all students. Like the HKALE, however, it will serve as the university admission examination under the Joint University Programmes Admissions System (JUPAS).

As part of the HKDSE, school students are typically required to take four core subjects (Chinese language, English language, mathematics and liberal studies), as well as two or three elective subjects (Hong Kong Examinations and Assessment Authority, 2012a). The elective subjects are offered in three categories (Hong Kong Examinations and Assessment Authority, 2012d):

- category A: 24 new senior secondary subjects
- category B: approximately 30 applied learning subjects
- category C: six other language subjects (French, German, Hindi, Japanese, Spanish and Urdu).

School-based assessment (SBA) is a salient feature of the HKDSE examination to be introduced from 2012 by phases. To enable schools and teachers to familiarise themselves with the new senior secondary curriculum as well as the SBA requirements and procedures, a strategic implementation strategy will be adopted in introducing SBA (Hong Kong Examinations and Assessment Authority, 2008b).

The HKDSE will be graded using standards-referenced reporting. This is the reporting of results against a set of pre-defined levels of achievement. At each of these levels, a series of performance descriptors set out what a student should be able to demonstrate at this level. This system enables stakeholders to understand what students know and can do when they have gained a certain level of performance (Hong Kong Examinations and Assessment Authority, 2012a).

The results for category A subjects will be expressed in terms of five levels of performance, of which 5 is the highest and 1 the lowest. The level 5 students with the best performance will be awarded a 5**, and the next highest group awarded a 5*. A performance below level 1 will be labelled as “Unclassified”.

For the first years of standard setting in the HKDSE, levels 4 and 5 will be set with reference to the performance standards achieved by students awarded grades A–D in the HKALE. This is important for ensuring a degree of continuity with past practice and for facilitating selection for higher education (Hong Kong Examinations and Assessment Authority, 2012a).

For category B, applied learning subjects, assessment will be undertaken by the course provider. After moderation by the HKEAA, the final results will be recorded on the HKDSE certificate. The results will be reported as “Attained” and “Attained with Distinction”.

For category C, other language subjects, marking and grading will be conducted by Cambridge international Examinations (CIE). Results will be reported in five grades (A–E), with grade E being the lowest and grade A the highest. Achievements below grade E will be designated Ungraded (Hong Kong Examinations and Assessment Authority, 2012d). Six language subjects (French, German, Hindi, Japanese, Spanish and Urdu) are offered to students in the HKDSE Examination. Question papers at the Advanced Subsidiary (AS) level from CIE will be used for the examinations of these six subjects (Hong Kong Examinations and Assessment Authority, 2012a).

International Baccalaureate Diploma

Total students: 49,049; achieved: 41,509 (2011 figures provided by IBO in February 2012).

The International Baccalaureate (IB) Diploma programme started in 1968 with first examinations in 1970, and is now offered by 2,311 IB World Schools. The programme is normally taught over two years at senior secondary phase, culminating in final examinations. Its aim is to prepare students, normally aged 16 to 19 "for success at university and life beyond" (International Baccalaureate Organisation, 2012e).

During the two-year course students:

- study six subjects; one chosen from each of the six subject groups: studies in language and literature, language acquisition, individuals and societies, experimental sciences, mathematics, the arts.
- complete an extended essay. This enables students to engage in independent research through an in-depth study of a question relating to one of the subjects they are studying.
- follow a theory of knowledge course (TOK). This encourages each student to "reflect on the nature of knowledge by critically examining different ways of knowing (perception, emotion, language and reason) and different kinds of knowledge (scientific, artistic, mathematical and historical)" (International Baccalaureate Organisation, 2012c).
- participate in creativity, action, service (CAS). This helps students to learn through experiencing real tasks beyond the classroom. Students can combine all three components or do activities related to each one of them separately (International Baccalaureate Organisation, 2012c).

Subjects other than languages may be taught and examined in English, French or Spanish and there are pilot projects taking place in German and Chinese.

Three of the six subjects are studied at higher level (each course representing 240 teaching hours) and the remaining three subjects are studied at standard level (each course representing 150 teaching hours).

Students take written examinations at the end of the programme, which are marked by external IB examiners. Students also complete assessment tasks in the school, which are either initially marked by teachers and then moderated by external moderators or sent directly to external examiners.

Each element of the IB Diploma is graded. There are seven grades, with 1 being the lowest and 7 being the highest. Students may be awarded up to 3 additional points for their combined results on TOK and the extended essay. Therefore, the highest total that a Diploma programme student can be awarded is 45 points (International Baccalaureate Organisation, 2012d).

The Diploma is awarded to students who gain at least 24 points, although this is subject to minimum levels of performance across the whole diploma including CAS. Each year, around 80 per cent of students taking the IB Diploma programme are awarded the Diploma. Less than 1 per cent of students gain the maximum 45 points (International Baccalaureate Organisation, 2012d).

Netherlands – *hoger algemeen voortgezet onderwijs* (havo)

Total students: 54,450; achieved 44,300 (Cito, 2010)

Since 1998, the havo has consisted of a five-year programme of study in preparation for higher education in technical subjects. The first three years or primary phase have common content and structure with the vwo primary phase. This is followed by a two-year upper secondary phase typically taken by students aged 16–18. The core curriculum includes: Dutch language, foreign languages, mathematics, history, science, and other subjects. The attainment targets prescribe what skills and knowledge students must have attained by the end of the third year.

The last two years of the havo programme consists of:

- a common component: Dutch, English, social studies, physical education, culture and the arts
- a specialised component: one of the following subject combinations including an independent project: culture and society (history and modern language), economics and society (mathematics A or B, history and economics), science and health (mathematics A or B, biology and chemistry), or science and technology (mathematics B, physics and chemistry)
- an optional component selected from: social studies, philosophy, management and organisation, information technology, physical education 2, a modern language, or further options available through the school.

The havo assessment is in two parts:

- the school examination. Each year schools submit their own detailed school examination syllabus to the Inspectorate of Education. The assessments, which form part of the school examination, must be completed and the results submitted to the Inspectorate before the national examinations begin in May.

- the national examination. External examinations are offered in all subjects although students are not required to take them for all their optional subjects.

The final mark in each subject is the average of the marks for the school and the national examinations. For subjects with only a school examination, the mark obtained is the final mark.

Marks are awarded on a scale from 1 (very poor) to 10 (excellent); 6 is a pass. Students can still be awarded an overall pass even if they get a lower mark in up to two subjects (two 5s or a 4 and a 5 are acceptable). Students who get a mark of 3 or lower in any subject have failed and in addition, students must have no more than one mark of 4 or 5 in their specialised subjects. From 2011/2 there will also be an additional requirement that students have no more than one mark of 5 in Dutch, English and mathematics.

Students who achieve the havo can apply for higher professional education, or study for a further year before applying to university.

Netherlands – *voorbereidend wetenschappelijk onderwijs* (vwo)

Total students: 40,000; achieved 36,500 (Cito, 2010)

Since 1998, the vwo has consisted of a six-year programme of study in preparation for higher education in academic subjects. The first three years or primary phase have common content and structure with the havo primary phase. This is followed by a two-year more specialised upper secondary phase typically taken by students aged 16–18. The core curriculum includes: Dutch language, foreign languages, mathematics, history, science, and other subjects. The attainment targets prescribe what skills and knowledge students must have attained by the end of the third year.

The last three years of the vwo programme consist of:

- a common component: Dutch, English, a second modern language, social studies, physical education, general science, culture and the arts or classical culture

- a specialised component: one of the following subject combinations including an independent project: culture and society (mathematics A, B or C and history), economics and society (mathematics A or B, history and economics), science and health (mathematics A or B, biology and chemistry), or science and technology (mathematics B, physics and chemistry)

- an optional component selected from: biology 1, economics 1, social studies 2, management and organisation, information technology, physical education 2, classical culture, Latin, Greek, or further options available through the school.

The vwo assessment is in two parts:

- the school examination. Each year schools submit their own detailed school examination syllabus to the Inspectorate of Education. The assessments which form part of the school examination must be completed and the results submitted to the Inspectorate before the national examinations begin in May.
- the national examination. External examinations are offered in all subjects although students are not required to take them for all their optional subjects.

The final mark in each subject is the average of the marks for the school and the national examinations. For subjects with only a school examination, the mark obtained is the final mark.

Marks are awarded on a scale from 1 (very poor) to 10 (excellent); 6 is a pass. Students can still be awarded an overall pass even if they get a lower mark in up to two subjects (two 5s or a 4 and a 5 are acceptable). Students who get a mark of 3 or lower in any subject have failed and in addition, students must have no more than one mark of 4 or 5 in their specialised subjects. From 2011/2 there will also be an additional requirement that students have no more than one mark of 5 in Dutch, English and mathematics.

Students who achieve the vwo can apply for places at university or in higher professional education.

New Zealand – National Certificate of Educational Achievement (NCEA) Level 3

Total students: 36,371, achieved 22,000 (New Zealand Qualifications Authority, 2010)

National Certificates of Educational Achievement (NCEA) function as New Zealand's main secondary school qualifications. Introduced between 2002 and 2004, they grew out of a long-term intention to "establish standards for national qualifications and recognise a wider range of skills and knowledge" (New Zealand Qualifications Authority, 2012d) The Ministry of Education is responsible for the development of the NCEA and the New Zealand Qualifications Authority (NZQA) is responsible for delivery.

According to the NZQA, the NCEA was designed to "challenge all students, including the most able and highly motivated. It was also designed to give schools the flexibility to develop a range of programmes to suit the specific needs of their students" (New Zealand Qualifications Authority, 2012d).

There are three levels of NCEA: 1, 2, and 3. At each level, students must achieve a minimum of 80 credits to gain an NCEA. Generally students complete level 1 standard subjects in Year 11, level 2 in Year 12 and level 3 in Year 13, although

credits can be gained over more than one year. In most cases 1 credit represents ten hours of learning and assessment. A typical course generates between 18 and 24 credits – so over five subjects, a student could aim for up to 120 credits.

There are no compulsory subjects, only a minimum number of credits required to gain a certificate at each level. Each year, students study a number of courses or subjects. In each subject, skills and knowledge are assessed against a number of standards. For example, a mathematics standard could be: “Apply numeric reasoning in solving problems”.

Students are assessed against the standards using a variety of internal and external assessments. High-achieving students are recognised for their performance at each level by gaining an NCEA with Merit or NCEA with Excellence (New Zealand Qualifications Authority, 2012b). If a student performs consistently above the “Achieved” level, result(s) can be “endorsed” to reflect their exceptional achievement (New Zealand Qualifications Authority, 2012e).

NZQA quality assures the NCEA through a formal process known as the Managing National Assessment Review (MNA). This ensures that the process is fair and consistent across all schools (New Zealand Qualifications Authority, 2012b).

For most subjects, all the externally assessed standards are assessed through an examination at the end of a school year. These are taken at the same time and date by all students. Some subjects (such as technology, visual arts) are assessed through submission of a portfolio. Unless specifically excluded by the assessment, students can present their answers in *te reo Māori* (the Maori language). In most subjects, students can request the examination booklet in *te reo Māori* (New Zealand Qualifications Authority, 2012c).

The Ministry has introduced a new curriculum for schools in 2010, which has resulted in a re-alignment of the NCEA achievement standards. These will be implemented fully in 2013 with new standards at NCEA Level 3. The analysis and findings in this study are based on the outgoing standards which will be examined for the last time in 2012.

Norway – *Vitnemål fra den Videregående Skole* (Certificate of Upper Secondary Education)

Total students: 26,394; achieved: 20,000 (Norwegian Directorate for Education and Training, 2010a)

Upper secondary education in Norway consists of 12 different education programmes. Completion of any of these earns students the general *Vitnemål fra den Videregående Skole* (Certificate of Upper Secondary Education), although depending on the programme taken, more specific qualifications are awarded alongside this.

Three of the 12 programmes are general studies programmes. These programmes take three years and normally serve the 16–19 age group. They lead specifically to a General University Admissions Certification (*generell studiekompetanse*) which qualifies students for general university admissions. Around half of those students in upper secondary education in Norway attend the programmes for general studies; the other half attend vocational education programmes (Norwegian Ministry of Education and Research, 2012a).

Common core subjects for general studies during the three-year programme include: religion and ethics, Norwegian / first language, mathematics, natural science, English, foreign languages, social sciences, geography, physical education and history. Students also study additional subjects from those available within their specialism.

- Specialisation in general studies (also includes physical education as a core subject):
    - natural science and mathematics subjects: biology; physics; geosciences; information technology; chemistry; mathematics; technology and theory of research
    - languages, social sciences and economics subjects: ancient language and culture; English; entrepreneurship and business development; foreign languages; history and philosophy; communication and culture; business economics; politics; the individual and society; psychology; tourism and languages; law; economics; Sami history and society
    - arts, crafts and design subjects: design and architecture; visual arts; Sami visual culture; scenography and costumes; printing and photography; visual culture and society
- Sports and physical education subjects: activities; sports and society; training management; theory of training; recreational sports; outdoor life; management development; top level sports.
- Music, dance and drama
    - music subjects: ergonomics and movement; direction and management; instrument, choir and ensemble
    - dance subjects: dance in perspective; basic training in dance; scenic dance; movement; dance techniques

- drama subjects: drama and society; theatre and movement; theatre in perspective; theatre production; movement; Sami music and stage; theatre ensemble.

The course materials define the number of hours of teaching and learning for each element of the programme (Norwegian Directorate for Education and Training, 2010b).

The student's progress is assessed by the teachers and this provides the information for the overall achievement marks on the student's school leaving certificate.

Examinations are prepared by the Directorate for Education and Training and are held in most subjects each year. These examinations are intended to provide a final assessment of the competence of each individual student. The subject curricula define the type of examination in each subject and whether this examination will be set locally or centrally The only compulsory examination is the third year (Vg3) assessment in Norwegian (or Sami, if that is their first language). Examinations in all other subjects are only taken by a sample of students as determined by the subject curricula. Students are not able to influence in which subjects they take their examinations. The results of the examinations are entered on students' school leaving certificates. At the end of a general studies programme leading to the General University Admissions Certification (*generell studiekompetanse*), "a student's school leaving certificate will contain just over 20 overall achievement marks and five or six examination marks" (OECD, 2011c, p.46).

Examination results are given as grades from 1 (fail), 2 (pass) up to 6 (highest) and students are expected to pass all courses.

People's Republic of China –*Gāokǎo* (National Higher Education Entrance Examination)

Total students: 9.57 million (Xinhua, 2010).

The *Gāokǎo* (or National Higher Education Entrance Examination) is an annual academic examination which has the purpose of selecting students for university admission. This examination is a prerequisite for entrance into almost all higher education institutions at undergraduate level. It is usually taken by students in their last year of high school, although there are no age restrictions on entry. To take part in the entrance examination, students must have a senior middle school graduation certificate (*Gaozhong*). Students with a vocational middle school certificate are officially also allowed to take the *Gāokǎo.*

Gāokǎo examinations are set by provincial-level examination authorities under the control of the National Education Examinations Authority (NEEA).

As part of the *Gāokǎo*, students are required to take examinations in a range of subjects over a three-day period. In most provinces students take the three core subjects, Chinese, mathematics and a foreign language (generally English) and either the humanities suite (politics, history and geography) or the science suite (biology, physics and chemistry). In some provinces there is an additional test, for example in Shadong province students take an additional basic skills proficiency test.

A maximum of 750 points are available from the examinations. Chinese, mathematics and a foreign language are worth up to 150 points each, and there are a further 100 points for each subject (up to three subjects) in the humanities and science combinations. The overall mark received by the student is generally a weighted sum of their subject marks.

Each province sets the lower limiting marks for each category of achievement. A student's category then determines for which higher education courses they are eligible to apply. Some provinces award additional points for non-educational achievements, for example in 2010 Shanxi recognised specific sporting achievements with additional points. There are also allowances for ethnic minority groups, for example, in 2010 Tibet set the lower limiting marks for ethnic Tibetans more than 150 marks lower than for Han (the Chinese majority ethnic group), while Xinjiang made smaller allowances for native Uyghur and Mongolian speakers.

Republic of Ireland – Leaving Certificate (Established)

Total students: 38,885 (Department of Education and Skills, 2010)

The Leaving Certificate (Established) (*Ardteisimeireacht*) is the most widely taken programme in the Republic of Ireland at upper secondary level. It is intended to provide "a broad and balanced education while allowing for some specialisation" according to the interests of a student (State Examinations Commission, 2009). The certificate is used for the purposes of selection into further education, employment, training and higher education. The Leaving Certificate (Established) is a two-year programme and typically students are aged 16 to 18. It is developed, assessed and certified by the State Examination Commission.

As part of the Certificate, subjects are normally studied at either Ordinary or Higher level. However, two subjects, Irish and mathematics, can be studied at Foundation level. Foundation level is geared to the needs of students who might have difficulty with those subjects at Ordinary or Higher level.

Students normally study six or seven subjects during the senior cycle, but must take a minimum of five subjects (unless they have entered the system after 11 years of age). Irish is the only core component of this, with students free to choose the rest of their programme. When choosing their subjects, students are advised to consider what subjects they will need to progress to their choice of further or higher education.

The Department of Education and Skills publishes syllabus and curriculum information for 35 subjects taken as part of the Leaving Certificate (Established). In addition some schools offer students the option to take the Junior Certificate programme in continental languages as part of their approved senior cycle course.

At the end of the two-year programme, the Leaving Certificate (Established) is assessed through a series of written examinations. Some subjects also have practical examinations and project work, for example in art, construction studies and engineering. There are oral examinations in Irish and continental languages. The practical and oral tests take place during the final year of the programme. The written examinations are held in June each year.

The results of the Leaving Certificate examination subjects are given in the form of grades. Each grade represents a percentage range of marks as follows (State Examination Commission, 2009):

Percentage range	**Grade**
90 or over	A1
85 but less than 90	A2
80 but less than 85	B1
75 but less than 80	B2
70 but less than 75	B3
65 but less than 70	C1
60 but less than 65	C2
55 but less than 60	C3
50 but less than 55	D1
45 but less than 50	D2
40 but less than 45	D3
25 but less than 40	E
10 but less than 25	F
less than 10	no grade

Republic of Korea – *Su-neung* (College Scholastic Ability Test, or CSAT)

Total students: 712,227

The College Scholastic Ability Test (CSAT) is a standardised test accepted by all South Korean universities. The CSAT is designed to measure students' scholastic ability as required for college education. It is developed and administered by the Korea Institute for Curriculum and Evaluation (KICE).

Prior to the CSAT, students complete their General or Vocational High School Diploma. Almost all high school students complete their three years of study and a high proportion continue on to university study. In 1998, 64 per cent of high school graduates progressed to higher education, with two-thirds of these pursuing traditional four-year degrees (International Review of Curriculum and Assessment Frameworks Internet Archive, 2008).

Each year, around 800,000 to 900,000 students take the CSAT. The majority of these are Year 12 students, however, a proportion are made up of students who are retaking the test having failed to gain a place at a higher education institution in the previous year.

Students can choose subjects of the CSATs to take according to their own needs and interests. The test "aims at evaluation based on thinking skills focused on cross-curricular issues in the subjects of language and foreign language (English) and the specific characteristics of each subject in the subjects of mathematics, social studies / science / vocational studies and foreign languages / Chinese classics" (Korea Institute for Curriculum and Evaluation, 2012b).

During the CSATs, students select all or some of five tests: language, mathematics, foreign language (English), social studies / science / vocational education, second foreign language / Chinese characters and classics.

All examinations are based on multiple-choice papers with five possible answers for each item. Marking of the examination papers is carried out using a technique called optical mark recognition (OMR) under the supervision of KICE and results are reported using stanine (standard nine) scores. Stanine scores are grades ranging from 1 to 9 and are based on a normal distribution – the top 4 per cent of students receive a grade of 1, the next 7 per cent receive a grade 2, the next 12 per cent a 3, the next 17 per cent a 4, the next 20 per cent a 5, the next 17 per cent a 6, the next 12 per cent a 7, the next 7 per cent an 8 and the bottom 4 per cent a 9 (International Review of Curriculum and Assessment Frameworks Internet Archive, 2008).

United States of America – ACT

Total candidates: 1.6 million (ACT, 2012a).

The ACT (originally an abbreviation of American College Testing) is a "curriculum- and standards-based educational and career planning tool that assesses students' academic readiness for college" (ACT, 2012b). It is one of the college entrance tests available to high school students in the USA. The test assesses high school students' general educational development and their readiness for entry-level college course work. The ACT is made up of a multiple-choice test and an optional Writing Test. The multiple-choice components cover college readiness skills in four content areas: English, mathematics, reading, and science. The ACT Writing Test measures skill in planning and writing a short essay (ACT, 2012a).

The content covered by each of the five tests "is drawn from the domain of each content area that educators agree is important to that content area and that is prerequisite to successful performance in entry-level college courses" (ACT, 2010a).

Tests are offered up to six times per year within the USA and five times a year at locations outside the USA. A student wishing to improve their score may take the test up to 12 times, subject to specific conditions (ACT, 2010b).

Therefore each year, multiple forms of the ACT tests are developed. Both the individual test forms and the entire battery of tests are subjected to a thorough quality control process before being released for use (ACT, 2010a).

There are five tests (the first four are multiple choice, the Writing Test is optional):

- The ACT English Test measures understanding of the conventions of writing through usage and mechanics (punctuation, grammar and usage, sentence structure) and rhetorical skills (strategy, organisation, style)
- The ACT Mathematics Test measures algebra, geometry and trigonometry skills over four cognitive levels (knowledge and skills, direct application, understanding concepts, integrating conceptual understanding)
- The ACT Reading Test measures reading comprehension in the content areas of prose fiction, humanities, social studies and the natural sciences
- The ACT Science Test measures the interpretation, analysis, evaluation, reasoning and problem-solving skills within the context of biology, chemistry, Earth / space sciences and physics
- The ACT Writing Test measures skills with a 30-minute persuasive essay task (ACT, 2010a).

For each of the four multiple-choice tests, the raw scores are converted to scale scores through statistical equating procedures. This ensures that scores reported across test forms have a constant meaning. Scale scores range from 1 (low) to 36 (high) for each of the four multiple-choice tests and the composite score. The composite score is the average of the four multiple-choice test scores; fractions of 0.5 or higher are rounded up to the nearest whole number.

Sub-scores are reported for the English, Mathematics, and Reading Tests. The scales for these sub-scores range from 1 (low) to 18 (high).

Two scores are reported for the optional Writing Test:

- a combined English / writing score on a scale of 1–36
- a writing sub-score on a scale of 2–12.

ACT also provides comments from one of the trained readers who scored each student's essay (ACT, 2010b).

United States of America – New York State Regents Diploma

Total students: 224,744; achieved: 146,000 (New York State Education Department, 2011b)

The Regents Diploma is aimed at all students completing high school. It provides students, parents, counsellors, administrators, college admissions officers, and employers with objective and easily understood achievement information for use in making sound educational and vocational decisions (New York State Education Department, 2012a). For students to be awarded the Regents Diploma, they first need to pass a series of Regents examinations. These examinations are achievement tests that are aligned with New York State's Learning Standards. They are prepared by teacher examination committees and New York State Education Department (NYSED) subject and testing specialists.

Regents examinations are available in English, mathematics (Integrated Algebra, Geometry and Algebra 2/Trigonometry), Global history and Geography, US history and Government, living environment and science (Living Environment, Earth Science, Chemistry, Physics).Unlike many of the qualifications in this study, the age at which students take examinations depends very much on the students themselves, and the progress of their study. Some students may take certain examinations as early as Grade 8 (age 13 or 14). Others may take them at age 17. Overall the high school course is scheduled to last four years, from Grade 9 to Grade 12.

Students need to complete a total of 22 credits and pass the Regents examinations (with a score of 65 or higher) in English, mathematics, science and social studies in

order to earn the Regents Diploma. To receive an Advanced Regents Diploma, students must also pass an additional Regents science examination (Earth Science, Biology, Chemistry or Physics), one or two additional mathematics examinations (geometry and algebra 2 / trigonometry if they have taken integrated algebra, or a choice of mathematics B or algebra 2 / trigonometry if they have taken mathematics A). The credit requirements for the standard Regents Diploma programme are as follows:

- English: 4 credits
- social studies: 4 credits (including a half-credit each in economics and government)
- science: 3 credits (including at least one credit each in both physical and life sciences)
- mathematics: 3 credits
- physical education: 2 credits
- visual arts, music or performance arts: 1 credit
- foreign language: 1 credit
- health: half-credit.

In addition to the credit requirements, all students must fulfil state requirements for education in technology and parenting. These mandatory requirements can be combined with other available courses in order to fulfil the 22 credit quota.

NYSED involves teachers from state schools in every stage of the test development process. This includes writing test items, pre-testing, quality controls and standard setting (New York State Education Department, 2012b).

Assessment takes place in June, August and January, and students can sit the examination once they have completed the appropriate course of study. The multiple-choice items are either machine-marked or marked by hand in schools, and the open-ended questions are marked by school scoring committees in accordance with the NYSED guidance. All raw marks are converted into scores at a local level using a conversion chart provided by NYSED.

University of Cambridge International Examinations A levels

University of Cambridge International Examinations AS and A level qualifications are provided by University of Cambridge International Examinations (CIE). They are available in a choice of 60 different subjects and are intended to provide good preparation for university entrance (University of Cambridge International Examinations, 2012d).

Cambridge International AS and A levels are designed to be flexible. Learners have the freedom to select the subjects that they would like to study based on their needs and interests.

Cambridge International AS levels can be offered either as a qualification in their own right, or as an element of the full Cambridge International A level. The AS level has half the content of a Cambridge International A level and is designed to be completed in one year. A full Cambridge International A level should take two years to complete and the course is aimed at students aged 16–19 years.

Assessment is designed to be flexible, with students able to take examinations in a "staged" fashion, or all in one examination season (usually at the end of the second year). Examinations sessions occur twice a year, in June and November, with results issued in August and January. As well as written examinations, orals, practicals, projects and coursework of differing types are all used in various subjects where they are the most effective and appropriate means of measuring attainment (University of Cambridge International Examinations, 2012d).

Cambridge International AS levels and A levels are graded qualifications. A student receives a separately certificated grade for each of the subjects that they take. The Cambridge International A level is reported on a grade scale from A* grade, awarded for the highest level of achievement, to E, indicating the minimum required performance. There is no A* grading in the certification of Cambridge International AS Levels, which report from grade A to grade E.

University of Cambridge International Examinations Pre-U Diploma

The University of Cambridge International Examinations Pre-U Diploma, or Cambridge Pre-U, has recently been developed by CIE specifically for students aged 16–19 who intend to progress to university studies. The Cambridge Pre-U aims to "prepare learners with the skills and knowledge they need to make a success of their subsequent studies at university" (University of Cambridge International Examinations, 2012e).

Cambridge Pre-U principal subject syllabi are linear courses. Students study each subject over a two-year course leading to final examinations which result in individual qualifications. However students may achieve a Cambridge Pre-U Diploma

comprising three individual subject courses with a mandatory independent research report and a global perspectives portfolio.

The qualification is intended to provide schools with an alternative to the A level and IB Diploma qualifications frequently used for admission to UK universities. It is currently available in 27 subjects.

The first examinations were taken by a small number of students in June 2009 (short course only) and June 2010 (for all short course and principal subjects) (University of Cambridge International Examinations, 2012e).

4 Findings: Mathematics

4.1 Summary

All the qualifications reviewed as part of this study share some common content ground, for example, all require the study of pure mathematics. They also hold similar aims and desired qualities that students would gain from taking the courses such as the development of thinking skills and analytical ability. However, there are notable differences between them.

For example:

- Many systems typically offer a variety of different mathematics courses (at different levels of demand and / or focusing on different aspects of mathematics) available to learners at senior secondary level.
- The balance between breadth of application and pursuit of complex and deep study. Many qualifications emphasise one over the other, and while either emphasis may result in a demanding qualification, overall it was found that having a broader range of applications allows students more flexibility in the pathways they can follow in higher education.
- Few qualifications offer students the opportunity to study mechanics in depth.
- Some allow calculators, while others do not. The use of graphic calculators in the Alberta Diploma and of more sophisticated technology as part of the NCEA Level 3 in New Zealand was of particular note.
- The number and depth of topics does significantly affect the level of demand of the qualification. For example, A levels are amongst a very small number that cover mechanics as part of the subject. In qualifications where the study of calculus and trigonometry are not studied to some significant level then demand is reduced.
- The requirement to study abstract and technically difficult mathematics generally make a qualification higher in demand. In particular A level Further Mathematics, both qualifications reviewed from Hong Kong, the IB Diploma, the Republic of Korea CSAT and the NSW HSC all fall into this category.

Many differences come down to the purpose of the qualification – is it intended to assess content and technique only or to address the need for students to solve problems and investigate? In many cases, the need to solve problems in context raises the demand but this is offset against lower technical demands. However, the place of mathematics in the qualification as a whole was not found as important in determining its demand, as there is no clear relationship between whether

mathematics was part of a baccalaureate-style qualification or a stand-alone qualification with its demand.

Other key findings include:

- There are different approaches to how the assessments are conducted: some qualifications have terminal examinations while others examine in a modular fashion.
- Some are based on closed written examinations and others on school-based assessment, and within this difference, the nature and style of the questions vary greatly and have a direct effect on demand.
- The time demand of the examination papers varies greatly as does the time allocation of the examinations.

A table summarising the key features of the assessments for each education system included in the study and a summary of what each course covers appear in Tables 6 and Table 10 of the Full Report Table Supplement.

Content, coverage and depth

All of the courses reviewed had a common aim: to provide a summative assessment at the end of secondary education which could be used to gain access to higher education or which could be used by employers to indicate the ability of the individual to carry out mathematical tasks and to solve problems. In addition to this many of the courses included a statement of philosophy regarding mathematics and its use to the individual and society.

Some of the courses concentrate much more on testing “college readiness”. In particular the ACT and the New York State Regents Diploma focus entirely on standardised testing for the pure purpose of college transfer.

A level Mathematics is a stand-alone qualification which serves to provide a summation of an individual's progress and achievement in mathematics. It can be studied alone and does not contribute towards a leaving certificate or a diploma. Other qualifications similar to this are: A level Further Mathematics, Hong Kong HKALE, CIE A level, Cambridge Pre-U and USA ACT.

Many of the qualifications reviewed are part of a leaving certificate or diploma. In these cases the study of mathematics is usually compulsory post-16, although not at a level comparable with A level for all students. The qualifications that require some form of mathematical study are the Alberta Diploma, Denmark STX, Finland Matriculation Examination, France *baccalauréat*, Hong Kong HKDSE, the IB Diploma, Netherlands havo and vwo, New Zealand NCEA Level 3, Norway *Vitnemål*, the People’s Republic of China *Gāokǎo*, the Republic of Korea CSAT and the New

York State Regents Diploma. For some of these qualifications it is necessary to gain a pass at some level in mathematics in order to achieve the certificate but for others, which are credit-based, it is not necessary to gain a pass in mathematics.

Although these differences between the qualifications are significant they do not, of themselves, appear to affect the level of demand of the mathematics qualification. Generally, the wider the remit of the diploma or certificate, the lower the demand of the mathematics required for successful completion.

The most striking difference between the objectives of the qualifications is that between content and process. Many of the qualifications such as Denmark STX, Hong Kong HKALE, Netherlands havo and vwo, New Zealand NCEA Level 3, People's Republic of China *Gāokǎo*, Republic of Korea CSAT, USA ACT and New York State Regents Diploma have content-based assessment objectives or similar whereas A level, A level Further Mathematics, the CIE A level, the France *baccalauréat*, the IB Diploma, New South Wales HSC, Norway *Vitnemål* and the Republic of Ireland Leaving Certificate (Established) have process-based objectives. This is however not indicative of demand or indeed of the level of process or problem-solving required of students by the assessments. For example, the two qualifications from the Netherlands have content-based assessment objectives but the written assessments involve students in process-based mathematics. In addition several of the other courses stress the need to address problem-solving as part of the learning of mathematics. For example the France *baccalauréat général*, the People's Republic of China *Gāokǎo* and the Republic of Korea CSAT *général* all stress the need to engage in problem-solving as a mathematical activity.

Some of the courses do not specify the teaching time required for the qualification. These included the USA ACT, the New York State Regent's Diploma, Denmark STX and Finland Matriculation Examination. A level Mathematics and Further Mathematics advise 360 guided learning hours as do the CIE A level and the New South Wales HSC courses. The Netherlands havo has 320 hours guided learning hours, Norway *Vitnemål* and Republic of Korea CSAT around 280 hours, the Alberta Diploma, the French *baccalauréat général* science specialism and the IB Higher around 250 hours and the Republic of Ireland Leaving Certificate 180 hours, whereas the Cambridge Pre-U suggests 380 hours, the Hong Kong HKALE 416 hours and the Netherlands vwo 600 hours, over three years. Again the number of hours recommended for course delivery does not seem to have a direct impact on the demand of the examination.

All of the courses reviewed require the study of pure mathematics. The number and depth of topics does significantly affect the level of demand of the qualification, notably where a course does not require the study of calculus and trigonometry to some significant level. The courses which do not require either or both of these topics are the Alberta Diploma, the Hong Kong HKDSE, the Netherlands havo and the USA

ACT and New York State Regents Diploma. At the other extreme the requirement to study abstract and technically difficult mathematics was judged to raise demand. In particular A level Further Mathematics, Hong Kong HKALE, the IB Diploma, the New South Wales HSC and the Republic of Korea CSAT all fall into this category. Topics which are common to these qualifications are the in-depth study of complex numbers, advanced algebraic techniques used to prove results and identities and the study of topics such as group theory. These five courses in particular provide students with a sound introduction to mathematical analysis.

The depth to which a topic was studied was significant in the judgement of demand. For example the ACT tests complex numbers but only superficially and this in itself is not enough to raise demand, whereas the in-depth knowledge required by the IB Diploma and A level Further Mathematics does significantly raise the demand of those courses. Depth of study more than number of topics was judged to be more important in raising the demand of the course.

A level Further Mathematics was the broadest and the deepest qualification reviewed. It is unusual, in that the study of three application disciplines, statistics, decision mathematics and mechanics, are offered. The next broadest qualification is A level Mathematics with two applications, statistics and mechanics, being most commonly studied. While some other qualifications come close, such as the Higher Level IB Diploma by requiring a significant amount of statistics and probability, only the Cambridge International A level, the Cambridge Pre-U and to some extent the New South Wales HSC require the study of a significant amount of applied mathematics. The requirement to adapt one's approach and mindset to different applications of mathematics was considered to raise the demand of the qualification. On the other hand qualifications such as the Hong Kong HKALE, the Netherlands vwo, the People's Republic of China *Gāokǎo*, and the Republic of Korea CSAT study a much narrower range of topics, often to a greater depth.

The balance between breadth of application and pursuit of complex and deep study was a major consideration when comparing the demands of different mathematics qualifications as part of this study. Both lead to a rise in demand; however having a broader range of applications allows students more flexibility in the pathways they can follow in higher education. Within the A level structure in England there is the option for students to study in depth by taking further mathematics and 15 per cent of students who study A level Mathematics take this up. Similarly the Hong Kong HKALE, the IB Diploma and the New South Wales HSC also have options within which students can increase their level of study.

It is marked that very few courses allow for the study of mechanics and decision mathematics. Only A level Mathematics and Further Mathematics allow students to study these areas in depth. The IB Diploma has an option in decision mathematics available to students. It is surprising given the significant role of decision

mathematics in the modern world that it does not appear in any other courses to any significant extent. However it must be said that many countries regard mechanics as a part of physics and that may be why it is absent from many of the mathematics courses.

Lastly there is the consideration of functionality in mathematics. As stated previously many of the courses listed process and functionality in their assessment objectives. The need to be functional with either a mathematical or a real-life context was considered to raise the demand of an assessment. However the assessment objectives are not always a clear indication of the type of questions faced by students in examinations.

Some courses such as Hong Kong HKALE and the People's Republic of China *Gāokǎo* study some topics which would be covered in first-year university mathematics in the UK; these topics tend to be very abstract and analytical, often relying on formal proof. They are undoubtedly challenging and difficult but are included by omitting the more applied options which enhance students' understanding of the role that mathematics plays in the world. They also do not recognise the change in the nature of mathematics which has come about through the use of sophisticated calculators and computers.

Many of the courses offer choices in their programmes of study. In the qualifications in which mathematics is compulsory post-16 often it is the ability of the student that determines which of the routes they will follow. In these countries there is a wide range of usually three or four programmes of study. In nearly every case the most challenging programme of study has been chosen to compare against A level Mathematics and Further Mathematics. The exception is the further mathematics of the Hong Kong HKALE and the IB Diploma but as student numbers for both these qualifications are so low they can be omitted from the study. In the UK, although post-16 mathematics is not compulsory, there is a huge range of qualifications which students can study of which A level Mathematics and Further Mathematics are only two.

A level Mathematics is unusual in that it offers six different routes of study. By choosing a different combination of applied units a student can tailor their course towards their chosen career path or higher education course. A level Further Mathematics offers students even more choice and courses can be tailored to a student's chosen career path. To a certain extent the Cambridge International A level offers a narrower but similar choice, as does the New Zealand NCEA Level 3. Other courses offer a limited choice of one module. This choice usually contains the option of doing more statistics and probability or more pure mathematics with a choice from topics such as group theory, differential equations and geometry. Such qualifications are the IB Diploma (Higher level), Hong Kong HKALE and, to a certain extent, New Zealand NCEA Level 3, where extra courses can be studied for extra credits.

Assessment

Two issues were judged to make a difference to the level of demand: examination timing and the presence or absence of coursework.

Several of the qualifications involve teacher or school-based assessment where up to 50 per cent of the final grade is made up of such assessment tasks. Such assessment can broaden a qualification and allow students to be tested on the application of IT, extended problem-solving and the use of mathematics as a tool for modelling that cannot be tested in an examination environment.

The examinations also fall into two categories: those which have terminal papers at the end of the course and those which are modular with papers that can be sat at various intervals during the course. On the whole the terminal papers raise demand as the students have to be tested on the whole course at once and these papers tend to be longer and more demanding. In particular the Cambridge Pre-U, the Hong Kong HKALE, the IB Diploma, the New South Wales HSC, the People's Republic of China *Gāokǎo* and the Republic of Korea CSAT Mathematics A are clear examples of this rise in demand. In these qualifications the terminal papers are demanding, with few questions that would act as a lead-in for the less able students and as the examinations are placed at the end of the course there is little testing of the work that came earlier in the course.

There is also less of an opportunity to re-sit examinations and improve grades with terminal examinations. It is clear that a modular examination requires less knowledge to be tested in one sitting as the course is broken up into modules and testing is carried out at the end of each section. This can lower demand. However, modular systems tend to have a longer overall assessment time and offer more opportunities for thorough testing which can increase demand.

The written question papers reviewed varied greatly in length and style. Individual questions also varied greatly in style, structure and demand. However, there were also many qualities shared by all of the papers:

- On the whole the question papers followed their courses closely and students would not be faced with any unexpected topics or processes. In A level Mathematics the assessment objectives were however not met, although the content requirements were represented well. The questions did not reflect the problem-solving required by the assessment objectives. Some awarding organisations wrote more balanced papers than others, for example in the IB Diploma, the A level, the Cambridge International A level and the Republic of Ireland Leaving Certificate the papers were designed to give comprehensive coverage of all the topics in the course, with no topic being over-represented, whereas in the Hong Kong HKALE papers there was a strong bias towards the analytical topics with, for example, proof by induction being tested four times

whilst other topics remained untested; this also occurred in the People's Republic of China *Gāokǎo* where a narrow band of content was tested.

- Nearly all of the questions reviewed were well written and students would have had no problems understanding what was required. When there was any doubt regarding this aspect it was usually due to the problems encountered in translation.
- Question papers were well designed with good clear diagrams, good use of white space and a reasonable level of literacy demand.
- Most of the papers gave students an opportunity to show what they knew, understood and could do, especially in the areas of mathematical techniques and methods.

Some of the papers consisted partially or wholly of multiple-choice questions. Often these questions did not stretch students as much as other types of questions, for example, in both the USA ACT and the Hong Kong HKDSE the options themselves gave students some help in reaching the correct answer. This style of question restricted the opportunity for students to show that they could communicate mathematically and did not allow students to demonstrate extended mathematical arguments. This is one reason why the ACT paper was judged to have a lower level of demand for students. This was also prevalent in the New York State Regents Diploma, the compulsory part of the Hong Kong HKDSE and in the pure mathematics and applied mathematics papers of the Alberta Diploma. Some courses, however, such as Republic of Korea CSAT and the People's Republic of China *Gāokǎo* also used multiple-choice questions but these tended to be very stretching for students. These questions were often worth a significant number of marks but there was no facility for part-marks and students lost just as many marks for one arithmetical slip as for a non-attempt of the question or a wild guess.

Many of the papers contained short-answer questions. These were used to test a limited range of mathematical methods or techniques where often the technique required was stated in the question. These were judged to be useful questions as they allowed students to show their ability to master mathematical techniques. The level of demand in these questions came from the technique or method being assessed, for example, carrying out a complex integration by substitution was regarded as more demanding than the integration of a simple polynomial. This sort of question was present in nearly all courses but particularly so in A level Mathematics, the Alberta Diploma, the Cambridge International A level, parts of the IB Diploma, New Zealand NCEA Level 3, the Republic of Ireland Leaving Certificate, the France *baccalauréat général* and part of the New York State Regents Diploma. They tended to be less prevalent in courses which had terminal rather than modular examinations.

Longer questions were found in the majority of the assessments reviewed; however they differed greatly in their nature:

- Some of the questions were not multi-part. They presented a significant problem and students were required to work out how to tackle the problem and select which mathematical methods were appropriate for solution. These questions were judged to have a high level of demand. They were most often found in the questions papers of A level Further Mathematics, Denmark STX, the Finland Matriculation Examination, the Hong Kong HKALE, the Netherlands havo, the People's Republic of China *Gāokǎo* and the Republic of Korea CSAT, where they were optional questions and were flagged as more demanding, and in one of the papers for the New South Wales HSC.

- Many questions were multi-part with the examiner leading the student through the solution of a significantly complex problem. This was done by structuring the earlier parts of the question to ensure that the student worked out the relevant identities, equations or information, hence giving clues as to what was expected in the final part of the question. Whilst the overall problem being tackled could be extremely complex, this level of structuring lowered the demand of the overall task. Some questions were more structured than others. These questions were often to be found in the papers of A level Mathematics, A level Further Mathematics, the Cambridge International A level, the Cambridge Pre-U, the France *baccalauréat*, the New Zealand NCEA Level 3, the Norway *Vitnemål* (R paper) and the Republic of Ireland Leaving Certificate.

- Lastly there were questions which were a combination of both the points above. The question was multi-part with up three small sub-parts leading the student into a context or mathematical context but without giving a significant degree of structure. The last part of these questions, usually with a high mark allocation, required the student to problem-solve and select further methods and techniques required for solution. These questions were regarded as having a high level of demand. They were particularly prevalent in the IB Diploma and this question style is the dominant factor in judging the high level of demand of this assessment. Similar questions could be found in the Cambridge Pre-U, the France *baccalauréat général* (S stream) and the Hong Kong HKALE.

The two Netherlands courses, the havo paper A and the vwo paper B, also contained extended questions which required students to engage significantly with a context either from real life or a more abstract mathematical context. Here the level of mathematical demand could be lower than in other questions but the student was required to interpret the context and select information and techniques to reach solution. These questions were regarded as having a high level of demand and were different from most of the other questions reviewed. It was disappointing to see that very few of the courses made any attempt to relate mathematics to real-life contexts

or situations. The only courses which attempted to do this were A level Mathematics and Further Mathematics, the France *baccalauréat général* (ES stream), Norway *Vitnemål* (S papers) and Republic of Korea CSAT.

This increase in demand regarding context was also recognised in the questions which required application of mathematics in fields such as statistics, mechanics and very occasionally discrete mathematics. In mechanics, although the mathematics was not as complex as in some of the pure mathematics topics the need to apply techniques within context and to solve problems raised the level of demand. This relates directly to the breadth of the course and questions of this type were found most often in A level Mathematics and Further mathematics as these are significantly the broadest qualifications.

The questions often rated as the most demanding mathematically tended to come from courses such as A level Further Mathematics, the Hong Kong HKALE, the IB Diploma (Higher level), Extension 2 Paper in the New South Wales HSC, the People's Republic of China *Gāokǎo* and the Republic of Korea CSAT. These often tested topics commonly found at the beginning of mathematical analysis and while they were technically demanding they were often extremely abstract.

The demand of a question was judged to be a blend of the technical difficulty of the mathematics required for solution and the strategy needed by the student in tackling a problem. Straightforward but technically difficult questions could be regarded as having a similar demand to those requiring less technical expertise but needing more problem-solving skills.

Using and applying mathematics in a real-life or mathematical context or via problem-solving was not just restricted to the most demanding courses overall and many good examples were found in A level Further Mathematics, the IB Diploma (Higher and Standard), the Netherlands havo and vwo, the New South Wales HSC, some of the papers from the New Zealand NCEA Level 3, the Republic of Korea CSAT (both Mathematics A and B), and the People's Republic of China *Gāokǎo*.

Questions were graded for complexity and strategy which broadly represent these two categories. In addition, the balance of the different types of question discussed above was also important in determining the overall demand of a paper.

Duration of assessments was also a factor. While a three-hour paper could be demanding in terms of the level of concentration required over time it also allowed students time to "settle into" the paper and to recover if a question did not go well.

Some of the qualifications with short examination times such as New Zealand NCEA Level 3 and in particular the USA ACT were regarded as demanding because a lot of information has to be processed in a short space of time, allowing students very little time to settle or develop their thinking.

Some of the papers had very generous time allowances, such as the Denmark STX, France *baccalauréat* and Norway *Vitnemål* This was in contrast with the People's Republic of China *Gāokǎo*, the Republic of Korea CSAT and four of the A level Further Mathematics modules where students have to complete a significant amount of challenging mathematics in a relatively short space of time.

A level Mathematics and Further Mathematics had the longest examination time which allows the course to be thoroughly assessed but it should be noted that many of the other courses also require a significant amount of school-based assessment.

In most cases the mark schemes were clear, detailed and should lead to consistency in marking. Some, such as the Hong Kong HKALE, were not available to students and teachers to discourage rote learning. This implies that there is likely to be a high predictability to the questions over time if learning solutions is considered to be possible. In courses such as the Alberta Diploma and the USA ACT all marking was carried out by computer as questions had either multiple-choice answers or were numerical response questions, requiring a digital answer only. In some qualifications such as the People's Republic China *Gāokǎo* and Republic of Korea CSAT marks were awarded in blocks and no part-marks were awarded for part solution or working out. Students were penalised as much for a small slip as for not attempting the question.

4.2 Mathematics findings by education system

Australia – New South Wales Higher School Certificate, or HSC

The Higher School Certificate (HSC) in New South Wales is designed to be studied by the full range of students, rather than only those planning to continue to university. Mathematics is an optional subject within the HSC. But around three-quarters do at least some mathematics as part of their qualification. There are three options within mathematics: to undertake mathematics alone (a two-unit course), to undertake Mathematics and Extension 1 (an additional unit) or to undertake Mathematics, Extension 1 and Extension 2 (another additional unit). Taking the HSC mathematics course and the extension 1 course uses about 30 per cent of HSC course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

Mathematics consists mainly of pure mathematics along with Euclidean geometry, probability and series and sequences. It is a subset of A level Mathematics with a much narrower range of topics and a lower demand than A level. Extension 1 consists broadly of an extension of those in the mathematics course, mainly pure mathematics with some probability and some content which could be classified as mechanics. The combination of mathematics and Extension 1 is still a narrower range of topics than A level but has a slightly higher level of demand. The additional Extension 2 results in the study of mathematics in the HSC course being much

higher than A level Mathematics (but lower than A level Further Mathematics) with the topics studied being a relatively small subset of Further Mathematics.

The most direct comparison with the A level is the combination of Mathematics plus Mathematics Extension 1. The purpose of this course is to allow students to progress to science, technology, engineering and mathematics (STEM) related courses in higher education. The Extension 2 course is designed for students with a special interest in mathematics who have shown that they possess a special aptitude for the subject.

The topics within the syllabus fit well together and, with the applications in aspects of mechanics and probability, allow for synoptic questions.

In addition to the written examinations there is also a level of teacher assessment for each level of qualification. The teacher-assessed component is primarily concerned with the student's reasoning, interpretative, explanatory and communicative abilities. There are no topic areas proscribed for the teacher-assessed component, only that they must reflect those topics in the syllabus. The school-based assessment provides teachers with the opportunity to give students tasks that are different in nature from the HSC examinations, such as investigative tasks, tasks that use different technologies and tasks over a longer timeframe. In addition, the school-based assessment typically is spread over several school terms and consists of three to five distinct tasks, each with a percentage weighting towards the total mark.

The Mathematics paper is three hours long with an extra five minutes for reading time. The questions were judged to be very well constructed with clear and concise language, good accurate diagrams and good use of white space. The time demand of the paper was judged to be fair. The less able students would have been able to access the paper and there were plenty of opportunities for them to show what they understood, knew and could do. Many of the questions spanned more than one topic but this usually meant that part (a) was one topic and part (b) a completely different topic rather than the questions being synoptic.

The range of demand of the questions was wide with the most difficult providing stretch and challenge for the most able students.

The Extension 1 paper is two hours long with five minutes' reading time. The questions were of a similar quality and nature to those in the mathematics paper. Again there was more than one topic in a question and demand varied from a methods question such as question 1 to problems which required more problem-solving.

The demand of this paper in combination with that of mathematics was judged to be above that of A level Mathematics. The increase in demand was due to two factors: the fact that the papers were terminal; and the nature of the questions which were

judged to have less structure than some of the A level questions. However this increase in demand was not seen as significant.

The Extension 2 paper is a three-hour paper with five minutes for reading. Again the questions were of good quality and this paper was considered to be much more demanding than A level Mathematics but less demanding than Further Mathematics A Level.

Canada – Alberta Diploma

The Alberta Diploma is designed to be studied by the full range of students, rather than only those planning to continue to university. Mathematics is a required part of the senior high school programme in Alberta. In order to transfer to a STEM-related course in higher education students have to study pure mathematics and applied mathematics at levels 10, 20 and 30. There are other courses available to students designed to help them become functionally mathematical and numerate outside of these that would meet the requirements of the Alberta Diploma. This study has reviewed Pure Mathematics 30 and Applied Mathematics 30 as a sample of what is required.

Taking applied mathematics or pure mathematics 10, 20 and 30 courses within the diploma programme uses about 15 per cent of Alberta Diploma course time. In England a typical student takes three A levels using about 30 per cent of their study time per subject. Pure mathematics emphasises mathematical theory and the testing of mathematical hypotheses. The pure mathematics studied, and the approach to the topics, contain little formal algebra and the use of graphical calculators play a key role in the learning of mathematics. The course does not cover abstraction and generalisation, and calculus is covered only in Mathematics 31 and even with the extended content students would find it difficult to transfer to a STEM-related higher education course in the UK.

Applied mathematics is a blend of approaches to everyday problems which is intended to give students a clearer picture of why they are learning mathematics. Whilst this functional approach is interesting it was considered that this programme was not a coherent body of knowledge, unless it was taught concurrently to pure mathematics. The topics within applied mathematics are: shape, space and measure; aspects of financial mathematics; some aspects of decision mathematics, some statistics and probability and one aspect of mechanics.

The assessment for the Alberta Diploma is 50 per cent school-based assessment and 50 per cent modular examinations. Very little is known about what comprises the school-based assessment and no comment can be made on the standard or benefit of this part of the Diploma.

Pure Mathematics 30 and Applied Mathematics 30 are each examined by a two-hour written examination, although another 30 minutes are available to students if they require the extra time. The examinations may be attempted in April and November with re-sits available in January, June and August. No information regarding the percentages of students re-sitting was available.

Both courses follow the same pattern of assessment. The first part of each paper is made up of 33 multiple-choice questions. Until recently the second part of the paper was made up of numerical answer questions and written answer questions; however the written answer questions have recently been dropped and now the second section consists entirely of numerical answer questions. All of the examination papers are now machine-marked. This means that there is now no opportunity for students to show what they know, understand and can do in the use of mathematics as a means of communication, of development of arguments and as a means to interpret statistical and other problems. It is assumed that this aspect of mathematics is assessed within the 50 per cent teacher-based assessment. The multiple-choice questions make up 82 per cent of the total marks with the remaining 18 per cent being numerical response.

The questions are drawn from a task bank. There are anchor items that appear in every session, which help to standardise the papers, and these are not released after the examination. The remainder of the items are unique items and these are used once only and then released into the public domain. The papers released for review are specimen papers consisting of multiple-choice, numerical response and written response questions. They are therefore from the old style of examination. A new style paper was not available for review.

The questions were clear, unambiguous and well laid out, with detailed and accurate diagrams. The wording was good and should cause no literacy issues. However there were a lot of questions and a considerable amount to read in the time given and it was felt this would raise the time demand of the assessment.

The demand of the questions was judged to be significantly lower than that of A level Mathematics. However, some of the material that would have increased the demand of mathematics study for the most able student may have been covered in Mathematics 31.

Denmark – *Studentereksamen*, or STX (Upper Secondary School Examination)

The *Studentereksamen* (STX) is designed to be studied by students intending to continue their academic studies at university. Students must do well in their lower secondary courses in order to be accepted for the STX. Mathematics is a compulsory part of the STX programme and may be taken at three different levels: A, B and C. A student may make up his or her STX from a range of subjects at different levels. For preparation for higher education in a STEM-related subject or a subject that

requires any form of statistical analysis it is necessary to study the STX level A in mathematics. This programme requires 325 guided learning hours which is roughly equivalent to A level.

Taking Mathematics A, B and C courses within the STX uses about 15 per cent of STX course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The assessment of the subject includes teacher marks which are awarded both during and at the end of the course, an extended project, an oral examination and a written examination. No information was available regarding the weightings of the different parts of the mathematics assessment which made a meaningful comparison difficult to achieve. The only information available to this review was that pertaining to the written examination.

Much of the content of the course is devoted to the basic mathematical topics in algebra, coordinate geometry and differential and integral calculus. The most notable absence is that of an in-depth study of trigonometry. There is a suggestion that modelling plays a significant part in the curriculum and this, it is assumed, is assessed via the class-based work. There is some mention of statistics but none of mechanics. The syllabus was much more limited than the A level.

Information was available on the written terminal paper only and therefore the judgements have been based upon this. Clearly there is some project component and an oral examination but no information was available regarding these assessments.

The five-hour paper is split into two parts: a non-calculator paper lasting an hour which needs to be completed first and then a written calculator paper which runs concurrently with the non-calculator paper.

The less able students would have been able to tackle at least half of the paper reviewed, and there were some unstructured questions which would test the most able. The questions had equal weighting but varied greatly in the level of demand. There was no gradient of difficulty as question 14 was much easier than question 1. However as the time given for the examination is very generous this should not present an issue.

There is no typical question as both demand and style vary enormously.

The questions exhibit roughly the same level of demand as A level Mathematics but as students in Denmark have significantly more time to complete the examination, this would overall make it less demanding than A level Mathematics.

England – A levels

The Edexcel A levels in Mathematics and Further Mathematics are designed to be studied by students who were successful in level 2 mathematics qualifications and wish to continue their studies although not necessarily to study mathematics at university. In both Mathematics and Further Mathematics after completing half the course, students may claim a qualification called the AS level, with the second half of the course being called A2. Together they make up the A level. A levels are offered by five different organisations in England, and they contain some variation although they are based on a common set of criteria set by us, as the regulator.

Taking Mathematics A level typically uses about 30 per cent of a student's A level course time. However around 15 per cent of students taking Mathematics A level also study A level Further Mathematics as a fourth subject, using about 50 per cent of A level course time for the combined subjects.

A level Mathematics

The Edexcel A level qualification is made up of four pure mathematics core units C1–C4 plus two applied units. There is a choice of two applied units from the six available: decision mathematics D1 and D2, mechanics M1 and M2, and statistics S1 and S2. D2, M2 or S2 may only be studied in the second year as a follow-on to their partner unit. The most popular combination is C1–C4 plus M1 and S1, and therefore this was used as the basis for comparison within this study.

The pure content consists of calculus, trigonometry, algebra and functions, series and sequences, vectors, logarithms and exponentials and curve sketching. The requirement to study a diverse range of mathematics, combined with the different approaches required for both mechanics and statistics, raises the level of demand of this qualification. It was found that the ability to apply the pure mathematics studied in different contexts was an important part of the qualification.

Each of the six modules is assessed by a one-and-a-half-hour closed examination. There is no coursework and the examinations all follow the same format, a question paper containing seven to eleven questions of varying length and mark allocation, all of which are compulsory. There are no optional routes within the papers. The module assessments may be taken in January or June. It is possible to re-sit these modules during the second year of study.

The statistics and mechanics papers allow students to show that they are able to apply pure mathematics to practical situations and both would be very helpful for students whose choice of higher education takes them into science, social science or engineering and technology degrees.

A level Further Mathematics

A level Further Mathematics is designed to be taken alongside A level Mathematics. In order to achieve A level Further Mathematics students need to complete a further six modules of study beyond those studied for A level Mathematics. The core is Further Pure 1 and either Further Pure 2 or 3 with another four modules being selected from the pure and applied options. For the purpose of this study the most common option pattern was selected: Further Pure 1, 2 and 3 and Mechanics 2, Statistics 2 and Decision 1. The further mathematics modules contain advanced calculus, vectors, an in-depth study of complex numbers and matrix algebra. The mathematics at this level is amongst the most demanding in this study, similar to Hong Kong HKALE and the IB Diploma Higher. In addition the Mechanics 2 module requires extensive problem-solving at this level and the Statistics 2 and Decision 1 modules serve to increase the diversity of the qualification.

This specification provides the broadest range of mathematics and its applications and the A2 modules in particular provide significant technical and problem-solving challenges for students, making this the most demanding programme of study reviewed.

Each of the six modules which comprise further mathematics is assessed by a one-and-a-half-hour closed examination. There is no coursework and the examinations all follow the same format, a question paper containing seven to eleven questions of varying length and mark allocation, all of which are compulsory. There are no optional routes within the papers. Some of the module assessments may be taken in January or June but some of the modules are only available in June.

The papers reviewed varied greatly in levels of demand. The AS (first year of study) modules such as Further Pure 1 and Decision 1 were comparable with the A level modules; however the modules such as Further Pure 2 and Further Pure 3 were very demanding, some of the most demanding assessments seen in the whole of the study. The questions were not only technically difficult but also required a degree of problem-solving strategies to reach a solution.

The coverage of the specification was good and most topics were assessed to some depth. The range of mathematics required by students was extensive and required considerable levels of expertise in pure mathematics combined with high levels of expertise in statistics and probability, mechanics and decision mathematics.

Finland – *Ylioppilastutkinto* or *Studentexamen* (Matriculation Examination)

The Matriculation Examination is designed to test students' level of achievement in their upper secondary studies. An overall pass entitles them to continue their studies at university. Mathematics, either at basic or advanced level, is a compulsory part of the Matriculation qualification. The purpose of the basic mathematics course is to provide students with the capabilities to acquire process, to understand mathematical

information and to use mathematics in different life situations and for further study. The purpose of the advanced mathematics course is to provide students with the mathematical capabilities required in vocational studies and higher education.

Taking both the compulsory and specialised additional mathematics courses within the upper secondary school programme uses about 20 per cent of Matriculation Examination course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The basic level covers a range of topics in mathematics and its applications. The advanced level covers a similar range of topics to the modules C1–C4 of the A level; there are no significant application topics at this level. There are ten core modules in the advanced syllabus and six in the basic syllabus. In addition there are three supplementary modules in the advanced level and two in the basic which can be studied on top of the core modules. Not all modules would take the same time to teach.

Students sit the examinations in either the spring of autumn of their final year. They are allowed to re-sit and about 14 per cent of students do so. The numbers sitting both the basic and the advanced level have remained relatively constant over the last ten years.

Both the basic and the advanced level papers were reviewed. Students sit only one terminal paper. Students choose 10 from 15 questions all of which are worth 6 marks but with two optional questions on the advanced paper being worth 9 marks – these are the “star’ questions. Despite the other questions all being worth the same number of marks there is a deliberate gradient of difficulty in the papers: “The Matriculation Examination Board shall endeavour to rank the test questions in an approximate order of difficulty from the easiest to the most difficult” (Matriculation Examination assessment materials). The students’ choice of question will therefore be very important in determining the standard of the questions that they face.

Many of the basic level questions are closed and require limited strategy, however some of the later questions are of a more open nature allowing students to select appropriate strategies. Later questions at the advanced level also contain more open and less scaffolded questions and these are regarded as challenging.

The basic paper reviewed was less challenging than the benchmark A level but some of the questions in the advanced level were more challenging owing to their less scaffolded nature. However without a time for the paper or a mark scheme it is difficult to make a final judgement. In addition, the level of demand would vary according to the choice of questions that students made.

France – *baccalauréat général*

The *baccalauréat général* is designed to be studied by students who were successful in the *Diplôme national du brevet* and may be planning to continue their studies at university.

The *baccalauréat général* is divided into three streams: literature, economic and social sciences and sciences. Each has an element of mathematics.

Taking both compulsory and specialisation courses for mathematics within the *baccalauréat général série* S uses about 25 per cent of *baccalauréat général* course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

- In the literature stream mathematics is a minor part of this strand and the course is heavily focused on basic algebra, statistics, arithmetic and geometry, in particular constructive geometry. This syllabus was judged to be significantly below the demand of A level.
- In the economic and social sciences stream the mathematics is broader than the literature strand, covering continuity of functions, differentiation, sequences, geometry and probability and statistics.
- In the sciences stream the mathematics contains significant calculus, trigonometry, functions, geometry, analysis and statistics. The content is not as broad as A level and contains no mechanics and less statistics but the pure mathematics content goes beyond the content of A level with topics such as complex numbers, proof by induction and aspects of 3D geometry.

In each stream students can elect to do mathematics or take it as a specialisation. The mathematics in the science stream is clearly the most demanding of the three with the mathematics being more demanding than A level but less diverse in its content.

An ethos for the course can be summarised as “research and study of speculation, resolving problems, argumentation, reasoning, demonstration”, which clearly expects the use of an investigative approach to mathematics teaching involving problem-solving and reasoning, together with rigorous mathematical proof. In contrast, content is listed in a formal, dry manner with few examples of real-life applications.

Each of the strands’ mathematics content has a terminal paper for mathematics and each paper has a weighting or a coefficient which counts towards the final certificate. There is no coursework element.

The time allocation, four hours for the science paper and three hours for the economic and social science and literature papers, appears to be very generous and it is assumed that students would finish well before the end of the time allocation.

The questions on all the literature and economic and social science programmes were scaffolded and the method of solution was clearly indicated. The questions in the science strand were more challenging and required more problem-solving.

The literature stream paper was judged to be well below the demand of A level Mathematics and the match between the questions and the syllabus was not good with the questions being concentrated on a relatively small part of the content.

The science stream paper was judged to be more demanding in technical difficulty than A level Mathematics but significantly less demanding than A level Further Mathematics. This is the closest comparator to A level Mathematics. The content is very abstract with only one question being set within a context. There was only one applied question in the paper – probability.

Hong Kong Advanced Level Examination, or HKALE

The HKALE is designed to be studied by students who were successful in Hong Kong Certificate of Education Examinations (HKCEE) sciences and wish to continue their studies at university. Mathematics is an optional subject within the HKALE, and there are three subjects in the suite: pure mathematics; applied mathematics and the advanced supplementary level mathematics and statistics. The first two are intended to develop higher mathematics in preparation to taking a STEM degree in higher education. The HKALE in Pure Mathematics was reviewed in this study as it has the biggest entry of the three.

A typical HKALE student taking mathematics A level alongside four AS subjects uses about 30 per cent of their A level course time for the A level. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The HKALE in Pure Mathematics is closest in content to the Edexcel A level in Pure Mathematics. The topic range is much narrower than the A level but reaches much higher levels than the A level reviewed, which includes mechanics and statistics. The topics in the syllabus are very analytical and extremely algebra-based. There is very little in the way of coordinate geometry and almost no vectors. There is no form of application whatsoever. The qualification is basically an introduction to mathematical analysis which would provide students with an excellent range of analysis techniques.

The emphasis is on conceptual understanding rather than method and applicability and there is a wide range of set proofs contained within the topics, some of which are examined. There is a clear emphasis on working with generality and many of the

topics contain work on general functions rather than techniques which can be applied in the transformation of mathematics.

There are two terminal papers of three hours each which are sat at the end of the course. However it should be noted that around 16 per cent of entries per year are re-sits. This is roughly in line with the number re-sitting modules in A levels.

Both papers have a similar design: section A, which consists of six compulsory questions and constitutes 40 per cent of the marks, and section B which offers students a choice of four out of five questions. The questions in section A are more straightforward than those in section B. These are challenging papers, with a relatively shallow gradient of difficulty which offer few concessions to students at the lower end of the ability range.

The questions are structured to enable students to work with a good flow through each large question. There are different access points to many of the questions, which means that if a student cannot access the first part then all is not lost. Several of the questions contain set proofs which appear in the course supporting materials and it is imagined that these could be learned by students and then repeated.

There is more than enough to test the most able students. Many of the large questions in section B go well beyond the mathematics available in A level Mathematics but it must be recognised that the range of topics is much smaller and the testing further narrows this range, for example vectors are not tested at all, but proof by induction comes up four times over the course of the two papers.

Both papers were found to have a significantly higher level of challenge than the present A level; however several factors should be taken into account when comparing levels of challenge:

- the relatively narrow range of mathematics and mathematical analysis tackled
- the absence of any mathematical applications
- the number of students passing at each level.

Hong Kong Diploma of Secondary Education, or HKDSE

The Hong Kong Diploma of Secondary Education (HKDSE) programme will replace the Hong Kong Advanced Level Examination (HKALE) from 2012. It is designed to be taken by all students. Students who secure good results in the HKDSE examination should be able to gain admission to overseas tertiary institutions. Mathematics is part of the HKDSE and comprises of a Compulsory Part and an Extended Part. All candidates must follow the Compulsory Part of the syllabus. The study of Compulsory Mathematics within the HKDSE uses between 10 per cent and 12.5 per cent of the total course time. If students elect to study the Extended Part as

well as the Compulsory Part, this uses around 15 per cent of the HKDSE course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

Compulsory Part

The HKDSE Compulsory Part will be assessed through a combination of external examinations and School-based Assessment (SBA). There are two external examinations; Paper 1 with a weighting of 55 per cent and a duration of two hours 15 minutes; and Paper 2 with a weighting of 30 per cent and a duration of one hour 15 minutes. The SBA will have a weighting of 15 per cent although during transition years the subject mark will be based entirely on the public examination results.

Paper 1 consists of three sections. Section A (1) consists of highly structured tasks assessing content that is deemed to be a pre-requisite to A level study (including indices, changing the subject of a formula, factorising quadratic expressions, percentages, problem-solving, volumes of solids, circle geometry, rotations and pie charts). Section A (2) and Section B consist of predominantly structured questions assessing a narrow sample of the content of the A level syllabus content.

Paper 2 consists of two sections and all tasks are multiple-choice questions. Section A contains 30 questions and assesses content that is deemed to be a pre-requisite to A Level study including algebraic manipulation, solving linear and quadratic equations, percentage change, algebraic formulae and substitution, ratio, direct and inverse proportion, area, circle geometry and sampling methods. Section B contains 15 questions assessing a narrow band of AS content. The nature of the questions in Paper 2 (multiple choice, correct answer amongst a choice of four) leads to a judgement that these questions are less demanding than the nature of the questions set in the A level assessments.

The SBA constitutes two assessment tasks. These tasks will be more extended in nature than the questions in traditional tests and examinations, and should provide opportunities for students to demonstrate their competence in the following skills and abilities:

- applying mathematical knowledge in solving problems
- reasoning mathematically
- handling data and generating information
- using mathematical language to communicate ideas.

Candidates submit two tasks. In terms of demand these are equivalent to material that is deemed to be a pre-requisite to A level study. The nature of these

assessments falls into three categories, a problem-solving task, a mathematical investigation and a data handling project.

Extended Part

The Extended Part features two modules, module 1 Calculus and Statistics, and module 2 Calculus and Algebra. Candidates can choose to take a maximum of one of these modules. Module 1 assesses a subset (calculus and statistics) of the content of modules C1, C2, C3, C4, S1 and S2 from the A level syllabus. Module 2 assesses a subset (calculus and algebra) of the content of modules C1, C2, C3, C4, FP1, FP2 and FP3 from the Mathematics and Further Mathematics A level syllabus.

Module 1 and module 2 are both assessed by a single paper of two hours 30 minutes' duration. Each of the papers consists of 14 questions which are highly scaffolded and are mostly in the form of multi-part tasks. These papers are significantly more demanding than the assessments in the compulsory part because the content, skills and techniques tested are significantly more complex. Additionally module 2 is more demanding than module 1 mainly because the algebra content of module 2 is more demanding than the statistics content of module 1.

The aim of the extended part is to allow candidates with good results to gain admission to overseas tertiary institutions. Whilst the Extended Part is more demanding than the Compulsory Part, students studying either part would struggle to access a mathematically-based UK degree course. Students of Extended Part module 1 would not have the breadth of knowledge required across all relevant strands of mathematics. Students taking the more challenging module 2 will have had the opportunity to demonstrate robust mathematical skills at pre-university entrance level in two strands of mathematics. However the lack of breadth in their knowledge would make it difficult to access a mathematically-based UK degree course, without further preparatory study of a mathematical application.

International Baccalaureate Diploma

The International Baccalaureate (IB) Diploma programme is designed to prepare students to continue their academic studies at university. Within the IB Diploma students must complete one subject within the mathematics and computer science group. Within the mathematics group there are four individual subject choices. Two of these are at standard level, Mathematics and Mathematical Studies, and two at higher level, Higher Level Mathematics and Further Mathematics. This study reviewed three of these: Higher Level Mathematics, standard level Mathematics and Mathematical Studies. Taking Higher Level Mathematics within the IB Diploma uses about 20 per cent of the course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

Higher Level Mathematics

The specification is very full and comprises a wide range of topics, with a strong emphasis on pure mathematics. There are seven core topics, one of which is statistics and probability with the rest being based in pure mathematics. Several of these IB Diploma core topics are located in the A level Further Mathematics units. No part of the syllabus offers mechanics, although vectors are included as a core topic. Students also have to study one further optional topic from: statistics and probability; sets, relations and groups; series and differential equations; and discrete mathematics. The option chosen for detailed review was statistics and probability as this most closely resembled the Edexcel A level. The statistics in this option would cover most of statistics units S1, S2 and some of S3 in the A level. All of the topics are developed to some depth and few, if any, tackle a branch of mathematics in a superficial way. The topics in this programme of study are more demanding than A level Mathematics but less demanding, when taken as a whole, than A level Further Mathematics.

In addition to two papers on the compulsory topics and one on the optional topic there is a requirement for coursework. Students are expected to submit two projects, one on mathematical investigation and one on mathematical modelling. These projects comprise 20 per cent of the final grade.

The three papers are taken at the end of the two-year course of study. Papers 1 and 2, focus on the compulsory topics. They are both two hours long whereas Paper 3 which focuses on the optional topic is only one hour long. In addition two projects must be submitted and these are worth 20 per cent of the final grade.

Papers 1 and 2 are split into two sections each worth 50 per cent of the marks. The questions in section A tend to be more straightforward, concentrating on methods and these questions allow access to the paper for the less able students. Section B comprises three large multi-part questions. There are some smaller part questions which lead students into the context before the last part, which tends to be a less structured problem. This part of the questions, worth at times from 7 to 9 marks, was considered to be challenging.

The questions reviewed were well written and well constructed and would provide excellent differentiation of students. It was found that the IB Diploma is more challenging than the A level benchmark. This is partially due to several factors:

- the extended, unstructured nature of many of the questions which require substantial arguments
- the increased technical level of the content when compared with A level
- the time demand of the papers which was considered to be very challenging.

Higher Level Mathematics was judged to be of a similar technical standard to A level Further Mathematics; however the A level encompasses a much wider range of mathematics and so is judged to be more demanding overall.

Mathematics

Mathematics (standard level) caters for students who possess good knowledge of basic mathematical concepts and who are already able to apply mathematical techniques to their daily lives. The majority of these students will expect to need a sound mathematical background as they prepare for future studies in subjects such as chemistry, economics, psychology and business studies. The syllabus is a subset of the higher level and does not cover as many topics as A level. Although statistics and probability are addressed there is no mechanics and many of the more advanced aspects of calculus and trigonometry, found in A level, are absent. Although there are a few simple topics such as matrices present, overall the programme of study was judged to be considerably less demanding than A level. This level also contains two projects which comprise 20 per cent of the marks for the qualification.

The standard level has the same format as the higher level. Papers are of a similar quality and mark schemes follow a similar format. Standard level was judged to be less demanding than A level Mathematics but the less structured questions of the higher level are repeated in standard level which raises the demand of the papers. These questions raise demand by asking students to think for themselves and solve problems within mathematical contexts. In addition the level of difficulty ramps up within whole questions, allowing access for less able students but stretching the most able in the final part.

Mathematical Studies

Mathematical Studies (standard level) caters for a wide range of students. Its purpose is to build confidence in, and an appreciation of, mathematics. Although students who study this course will progress to higher education it is not anticipated that they will need mathematics for their future studies. The course covers a fairly narrow range of topics, with the emphasis being placed on the application of mathematics to topics that relate to home, work and leisure situations. The intention is to introduce the basic concepts of number, algebra, functions, geometry, trigonometry, statistics and differential calculus, so they can be applied to solving problems. As in the two other levels clear emphasis is placed on the use of the graphical calculator to solve problems. This level also contains a project worth 20 per cent of the qualification.

The Mathematical Studies assessment has the same format as both the higher and standard levels. It was judged to be a much less demanding set of papers than the A level, between GCSE and AS level. Papers are of a similar quality and mark schemes follow a similar format. Questions tend to be extremely structured.

Netherlands – *hoger algemeen voortgezet onderwijs*, or havo

The *hoger algemeen voortgezet onderwijs* (havo) programme is designed for students intending to continue their studies in technical subjects at higher education institutions. There are three possible options within the havo. Students who study the Culture and Society programme need not choose to do mathematics and many do not. Students who undertake the Economics and Society and Nature and Health programmes study Mathematics A and those who do Nature and Technology study Mathematics B. As Mathematics A is the most popular option it was chosen for this review.

Taking mathematics within the havo programme uses about 15 per cent of havo course time. In England a typical student takes three A levels using about 30 per cent of course time per subject. The main focus of the programme of study is the use of mathematics within context and for functionality. The course includes a significant amount of statistics, geometry and data transformation, including logarithms and exponentials, but it does not include any significant calculus or trigonometric techniques. The emphasis is very much on modelling and problem-solving. The course resembles the UK AS level Use of Mathematics much more than it resembles AS Mathematics. Like AS Use of Mathematics the technical demand is lower than AS Mathematics but the ability to use mathematics in context is much higher than AS Mathematics. It was considered that the topics for Mathematics A were much narrower and much less demanding than those in A level Mathematics. The topics were also considered to be less demanding than the combination of core units C1, C2 and statistics unit S1 in the Edexcel AS Level Mathematics.

The assessment of the programme consists of 50 per cent written examination and 50 per cent school-based tests. Schools are given a fairly free hand in what constitutes school-based tests. Some suggestions are open book tests, projects, group tests, digital on-screen tests taken throughout the year, oral tests, practical assignments and the National Mathematics Olympiad.

The examination is three hours long and students are allowed calculators for the duration of the examination. The questions reviewed were of high quality, giving good examples of contextualised question-setting. Success is process driven and students have to develop problem-solving skills and need to be able to interpret the questions and then apply and use techniques to answer them. They are a very different style of question compared with the other qualifications reviewed. The questions appear to be very wordy and some of the language is not straightforward but it was felt that something was lost in the translation of the questions into English. There are five developed contexts with three to six questions relating to each context.

The questions were judged to be excellent and relevant with the mathematics coming naturally from the contexts. The overall demand was more consistent with that of AS level Use of Mathematics than that of A level Mathematics.

Netherlands – *voorbereidend wetenschappelijk onderwijs*, or vwo

The *voorbereidend wetenschappelijk onderwijs* (vwo) programme is designed for students intending to continue their academic studies at university. Mathematics is compulsory for all four sub-programmes at vwo. Students who follow the Culture and Society programme will do Mathematics C although they can, if they are able, opt for Mathematics A or B. Students who follow Economics and Society and Nature and Health can choose to do either Mathematics A or B. Students who follow Nature and Technology have to choose Mathematics B. It was therefore decided to review Mathematics B.

Taking mathematics within the vwo programme uses about 15 per cent of vwo course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The content of the syllabus is narrower than the UK A level, concentrating on geometry, trigonometry, calculus and algebraic techniques. There is no statistics or mechanics but there is an emphasis on geometry. The geometry context of cutting with a height line is a significant exploration of Euclidean geometry and this is unusual in the qualifications reviewed. As with the havo, the emphasis is on process and modelling concepts and content in specific real and purely mathematical contexts. The range of topics may be considerably narrower but the depth of treatment and context-based mathematics makes this a rich course. However the school-based tests can be devised by the school and this may well be an opportunity to widen the range of topics. There was not enough information available on the school-based work to make a judgement on this.

The assessment of the programme consists of 50 per cent written examination and 50 per cent school-based tests. Schools are given a fairly free hand in what constitutes school-based tests. Some suggestions are open book tests, projects, group tests, digital on-screen tests taken throughout the year, oral tests, practical assignments and the Mathematics Kangaroo Tests (an international mathematics competition).

The written examination is three hours long with 17 questions set within six mathematical contexts and one real-life context. There are one to four questions relating to each context. The questions are very demanding in both interpretation of the context and in the degree of difficulty of the mathematics required. Overall, despite the range of topics being narrower than the Edexcel A level it was judged that the demand of the Mathematics B paper is significantly greater.

New Zealand – National Certificate of Educational Achievement, or NCEA Level 3

The National Certificate of Educational Achievement (NCEA) is designed to be accessible to the full range of students rather than only those planning to continue their studies at university. Mathematics is an optional part of the NCEA. Taking NCEA Level 3 mathematics uses about 20 per cent of NCEA course time, because a student typically studies five subjects. In England a typical student takes three A levels using about 30 per cent of course time per subject.

Students can study mathematics in three different areas:

- Calculus: choice of up to five modules covering extensive calculus, conics, complex numbers and graph sketching (up to 24 credits).
- Calculus CAS: choice of up to four modules covering extensive calculus, conics, complex numbers and graph-sketching. Note this covers the same ground but is a project involving the use of technology (most notably, allowing the use of algebraic calculators). These units cannot be done in combination with any of the calculus units (up to 24 credits).
- Statistics and Modelling: up to seven modules covering similar statistics and probability topics as the A level Mathematics S1 and part of the S2 modules plus internal assessment involving extensive use of technology, curve fitting and numerical solutions of equations (up to 24 credits).

The Calculus CAS course in particular was found to be very interesting due to its use of technology and was more demanding than doing the Calculus course. As students are allowed to use algebraic calculators as a routine part of the course, they gain experience in using technology they would use in higher education. Both the Calculus and the Statistics and Modelling courses were judged to be more demanding (but much narrower) than A level Mathematics, but less demanding than A level Further Mathematics in combination with Mathematics.

There is no coverage of mechanics in the NCEA and while the pure mathematics content extends into further mathematics at times, overall it is narrower than the Edexcel A level Pure Mathematics content.

Each externally assessed unit is examined by a closed written examination varying from 40 minutes' to 65 minutes' duration. All the examinations consist of two multi-part questions. Each question provides an opportunity for demonstration of all grades of performance. A single grade is awarded for each question and then an overall grade is awarded for the paper. Showing working out is encouraged and students who do not show where their answers come from can be heavily penalised.

The questions in the calculus papers are very much technique driven and little attempt is made to provide even a mathematical context. The calculus CAS papers are more diverse and require the students to work within mathematical and occasionally real contexts. The questions are structured so that students can achieve the grade bands within each question. This means that although the questions are multi-part, the parts are not developments of one another and so the questions are not scaffolded but neither are they truly multi-part. It was judged that the demands of these papers came from having to successfully tackle technically demanding techniques in a limited amount of time.

The statistics and modelling papers follow the same two-question design as the calculus papers. Here however the questions are context-based and the context usually covers all the parts of the question, or even both questions. Once again the separate parts of the question tend to be independent of one another and so the questions cannot be said to be truly multi-part. It was judged that the demand of these papers came from having to successfully process data and information in a short time as well as having to work on some technically demanding statistical processes.

Overall it was found that the demand of these questions was slightly higher than that of A level Mathematics as the time demand was high; however the papers also cover a much narrower range of mathematics than do the A level modules and this must be taken into account in judging overall demand.

The ministry has introduced a new curriculum for schools in 2010, which has resulted in a re-alignment of the NCEA achievement standards across all three levels. These will be implemented fully in 2013 with new standards at NCEA Level 3. The analysis and findings in this study are based on the outgoing standards which will be examined for the last time in 2012.

Norway – *Vitnemål fra den Videregående Skole* (Certificate of Upper Secondary Education)

The *Vitnemål fra den Videregående Skole* (Certificate of Upper Secondary Education) general studies programme is designed to be studied by the full range of students, rather than only those planning to continue mathematics at university. Mathematics is a compulsory subject. There are two programmes of study, Mathematics S (for social studies) and Mathematics R (for natural science and mathematical studies). Both were reviewed as part of this study.

Taking both mathematics 1 and 2 courses within either the natural sciences or social sciences upper secondary school programme uses about 10 per cent of the *Vitnemål* course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

Mathematics S was judged to be below the demand of A level Mathematics and roughly equivalent to C1, C2 and S1. Mathematics R has a strong emphasis on pure mathematics with a small amount of probability included. Mechanics is not studied at all, although vectors are included as a core topic. Students may study just the core mathematics plus the R1 course, before choosing to either finish their mathematics study at this point, pursue Mathematics X which is a course involving a significant study of the history of mathematics, or continue to study for the R2 module. The content of R2 is required in order to bring the course up to A level standard. The course was judged as being much narrower in its curriculum than A level Mathematics but there are some pure mathematics topics that are found in further mathematics such as proof by induction, 3D geometry and some aspects of differential equations.

Emphasis is placed on modelling and solving problems, particularly for R2; for example: “interpret the definite integral in models of practical situations”; “formulate a mathematical model with the help of central functions on the basis of observed data, process the model and elaborate on and discuss the result and method”; and “model practical situations by converting the problem to a differential equation, solving it and interpreting the result”.

Students may study only for R1 or for R1 and R2. R1 was judged to be less demanding than A level Mathematics while R2 was judged to have some demanding questions in the paper. Taken together both papers were judged to be at a similar demand as A level Mathematics, although the breadth of topics in A level Mathematics meant that overall it was judged to be more demanding.

Both papers follow a similar format. They are attempted at the end of the course and both are five hours long. Part 1 of the paper consists of two exercises and is handed in after two hours have elapsed with part 2 consisting of five exercises which are handed in after five hours have elapsed. The time allowance is extremely generous and it is difficult to imagine that students would require the full five hours.

People’s Republic of China – *Gāokǎo* (National Higher Education Entrance Examination)

The People’s Republic of China *Gāokǎo* is designed to select students for study at universities and other higher education institutions. The *Gāokǎo* is taken by students after they have successfully completed senior secondary education. Mathematics is a compulsory section of the *Gāokǎo*. The emphasis of the course is to achieve three levels of attainment: knowledge, comprehension and mastery. There is an emphasis on problem-solving in the qualification. Students study a range of topics with the emphasis on pure mathematics. Calculus only covers the differential calculus and this is very unusual amongst the qualifications that are part of this study. There is a significant amount of geometry, with the main focus on geometric reasoning. The

algebra and functions topics have a very analytical focus and there is an emphasis on formal proof.

The topics are very demanding but the use of a calculator is not promoted and this restricts the nature of the mathematics taught. As with the Hong Kong qualifications, the syllabus is technically challenging but narrow.

The examination is a terminal paper comprised of four parts with a possible maximum score of 150 marks and a time allocation of two hours.

The questions analysed for this study were translated and so little can said about their clarity; however diagrams were clear and representative. The questions were regarded as significantly more demanding than A level Mathematics and there is a clear emphasis on formal proof, geometric proof and series and sequences. Coverage of the syllabus is very narrow with little or no calculus, no vectors and very little trigonometry. The questions cover a very narrow and formal range of mathematics. Calculators are not allowed and this restricts some of the mathematics that can be tested.

Overall the demand of the paper was judged to be higher than A level Mathematics but lower than Further Mathematics and much narrower in its remit.

Republic of Ireland – Leaving Certificate (Established)

The Leaving Certificate (Established) is designed to be studied by the full range of students in the senior cycle (upper secondary), rather than only those planning to continue their studies at university. Mathematics is optional within the Leaving Certificate, although most students opt to take some mathematics as part of their study. Mathematics can be studied at three levels: foundation, ordinary and higher, and there is a further subject in applied mathematics that can be taken alongside the higher level mathematics course. Foundation level mathematics is geared towards vocational and functional mathematics. Ordinary level mathematics is essentially a service subject, providing knowledge and techniques that will be needed in the future for the study of scientific, economic, business and technology subjects. This study considered the higher level course.

Taking higher level mathematics within the Leaving Certificate uses about 20 per cent of Leaving Certificate course time because a student typically studies five subjects. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The syllabus contains a wide range of pure mathematics topics with a small number of discrete and statistical topics also being included in the core. Several of the core topics can be located in the A level Further Mathematics AS specification. These include proof by mathematical induction, complex numbers and matrices. Mechanics

is not studied at all although vectors form part of the core content (vectors are, however, included in applied mathematics).

Students are also offered a choice of four optional areas of study; usually one is chosen by the school or college. These topics are: Further Probability and Statistics; Groups; Further Geometry; Further Calculus and Series. Almost all students take the Further Calculus and Series option. A school or college could extend the mathematics curriculum by studying more of these topics and this in turn would allow students a wider choice of questions in the terminal papers.

The ordinary and the higher courses are each examined by two terminal papers, both worth 300 marks and both lasting two hours 30 minutes. The weighting of the two papers appears to be equal but it is not stated in the supporting materials. Paper 1 offers students a choice of six from eight questions with each question being worth 50 marks. It was felt that not all of the questions had an equal level of technical or time demand and choice of questions could alter the overall level of demand of the paper.

The mark schemes are interesting in that each part of the question is usually worth 5 or 10 marks, with other parts worth 15, 20 or 25 marks and then marks are deducted for a variety of errors. Mathematical error or omissions, called “blunders” cause a deduction of 3 marks; “slips”, usually a numerical error, result in a deduction of 1 mark and “misreadings” also result in a deduction of 1. However detailed guidance is given and the schemes should result in consistency of marking.

The demand of these papers was judged to be very close to that of A level Mathematics; however the lack of mathematical applications, combined with the narrowness of the syllabus, meant that overall the qualification was judged to be marginally less demanding.

The Republic of Ireland has recently changed its Leaving Certificate Mathematics course under an initiative called Project Maths, with teaching of the new syllabus commencing in September 2010 and the first changed examinations scheduled for June 2012. This new course comprises of three syllabus levels similar to those of the present Leaving Certificate. The new syllabus is organised into strands of mathematics and while it contains a greater proportion of statistics and probability it remains predominantly pure mathematics. There are no optional topics in the course and the content is roughly equivalent to the old syllabus core plus the further statistics and probability option. The major change in the new course is a much greater emphasis on the application of mathematics in context and in solving problems. Two of the five strands in the course have been changed for teaching from 2010 with the remainder being changed in two further phases from 2011 and 2012.

Republic of Korea – *Su-neung* (College Scholastic Ability Test, or CSAT)

The Korean College Scholastic Ability Test (CSAT) is designed to select students for study at South Korea's universities and other higher education institutions. Mathematics is compulsory within the CSAT and there are two options, A and B. Mathematics B is a subset of Mathematics A. In both Mathematics A and B there is an onus on the development of "the ideal person" as "someone who pursues own identity, displays creativity, opens a direction, creates new values and contributes to community development, and mathematics can play a significant role in realising this ideal person model" (CSAT assessment materials).

Throughout the documentation reviewed, there is a balance in the approach adopted, on the one hand promoting the development of students' understanding of concepts, principles and rules while, on the other, encouraging the development of mathematical thinking, reasoning, problem-solving and a positive attitude towards the subject. Setting problems in real-life contexts is an approach that teachers are encouraged to adopt in order to engage students' interest.

The syllabus for Mathematics A contains a wide range of topics, with a strong emphasis on pure mathematics, although aspects of probability and statistics are also included. There is no coverage of mechanics but vectors are covered as part of the course. Some of core topics are located in the A level Further Mathematics units. These include: proof by mathematical induction; solving systems of linear equations with three unknowns; coordinate geometry of the parabola, ellipse and hyperbola; equations of lines and planes in 3D; and matrices. This is a relatively narrow but challenging programme of study.

There is an emphasis on calculators and computers but interestingly these are not allowed in the examination, thus restricting the topics that can be thoroughly tested.

Both Mathematics A and Mathematics B are assessed by a terminal examination of one paper lasting 100 minutes. These papers are examined on the same day as all the other CSAT papers in the other subjects. There is no coursework and judging by the question paper and answers, calculators are not allowed. The paper has an emphasis on proof and algebra There are few questions set in context and probability is the only application of mathematics tested. It was judged that time demand in this paper would be very high.

Both papers consist of 70 per cent multiple-choice questions and 30 per cent short-answer questions. Students transfer their answers on to an answer paper and answers are marked right or wrong – there are no part-marks. A student making an arithmetical slip is penalised as much as a student who does not attempt the question or who guesses the answer.

Mathematics B was judged to be less demanding than A level Mathematics but more demanding than the AS component of A level Mathematics. The assessment topics cover a narrow range, and questions vary from relatively straightforward (such as question 2), to question 14 which is much more complex. The problem-solving in this paper raises demand significantly. Question-setting was judged to be of a high standard with imaginative use of mathematical contexts.

Mathematics A was judged to be more demanding than A level Mathematics but less demanding than A level Further Mathematics. There are common questions between Mathematics A and B and these would be the more accessible questions for students of this paper. The level of demand in this paper comes from two sources: some questions, which although they are not technically demanding, do involve a lot of thought while others demand a combination of technical mathematics and considerable problem-solving skills.

Although the range of mathematics is narrow compared with A level, with little in the way of applications, it is the emphasis on problem-solving that raises the demand of this paper. It was judged that this assessment, along with the Hong Kong qualifications, had some of the most demanding questions.

United States of America – the ACT

The ACT is designed to assess how well prepared upper secondary students are to study in higher education. Mathematics is a compulsory part of the ACT. The ACT mathematics test adheres to test specifications that are informed by data and research and confirmed every three to four years. There is no syllabus for these tests; however the topics included in the test are based on USA curriculum units Algebra 1, Geometry and Algebra 2.

The assessment consists of 60 multiple-choice questions which are completed in one hour. Questions 1–47 were judged to be similar to GCSE Mathematics. From question 48 onwards there is a steep rise in the gradient of difficulty. The content in this part of the paper is on a par with some aspects of A level C1 and C2 but the questions are not developed in any way to test the ability of a student to tackle a slightly extended problem. Time pressure would be a significant factor as there is a lot to read and process in one hour.

The content of the test coverage was judged to be below that of A level Mathematics. However the items included in the mathematics test are intended to cover four cognitive levels: knowledge and skills, understanding concepts, direct application and integrating conceptual understanding.

United States of America – New York State Regents Diploma

The Regents Diploma in New York State is designed to be studied by the full range of students, rather than only those planning to continue their studies at university. Mathematics is a compulsory subject within the Regents Diploma All students study at least integrated algebra which can be considered equivalent to studying GCSE Mathematics in England. However to receive an Advanced Regent's Diploma a student must pass Algebra 2 / Trigonometry B which contains topics in algebra, trigonometry and statistics and probability, similar in range to parts of C1 to C3 of the A level. The Regents Diploma contains no calculus, limited trigonometry, a very small proportion of statistics and no mechanics.

All students take mathematics within the diploma which uses about 15 per cent of Regents Diploma course time. The mathematics courses delivers three of the 22 credits that students are expected to gain through their study within the high school programme. In England a typical student takes three A levels using about 30 per cent of course time per subject. Examinations are usually taken in January or June with an opportunity to re-sit after summer school in August.

The examination paper is three hours long and is sub-divided into four parts. All parts of the assessment are compulsory.

The range of demand of the questions is considerable. Some questions, especially within the multiple-choice section, allow weaker students to show what they can do and part 2 would also be accessible. Parts 3 and 4 allow the stronger students to show what they can do and there is some stretch and challenge. However, overall, the demand of the Regents Diploma is lower than A level Mathematics, which would be expected given the age at which students typically take these examinations.

University of Cambridge International Examinations AS levels and A levels

Cambridge International A level qualifications are designed primarily for students who intend to continue their studies at university. Mathematics is an optional subject choice. As with the A level in England, a typical student takes three A levels using about 30 per cent of their A level course study time per subject.

There are three options: Pure Mathematics with Mechanics and Statistics, Pure Mathematics with Statistics and Pure mathematics with Mechanics. Further Mathematics is also available. For this review the Pure Mathematics with Mechanics and Statistics option was considered as this is the most common choice and the one which most closely corresponds with the Edexcel qualification.

The need to study a diverse range of mathematics, combined with the different approaches required for both mechanics and statistics serve to raise the level of demand of this qualification.

The content of the Cambridge International A level closely follows that of A level Mathematics. However a few Cambridge International A level core topics are located within the A level Further Mathematics units, including complex numbers. There is a balance of content in each module and this allows opportunities to develop synoptic teaching and learning. The modules may be examined in one sitting at the end of the course or they can be taken when ready at either June or November sittings.

The assessments were considered comparable to A levels.

University of Cambridge International Examinations Pre-U Diploma

The Cambridge Pre-U is designed for students who intend to continue their studies in science at university. Mathematics is an option within the Cambridge Pre-U. Both mathematics and further mathematics are offered as subject disciplines. This study reviewed the subject mathematics. Taking mathematics within the diploma uses about 25 per cent of Cambridge Pre-U course time, because a student studies global perspective and research in addition to their three chosen subjects. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The subject is assessed at the end of the two years of study by a pair of closed three-hour written papers. There is no choice within the syllabus. Two-thirds of the topics are targeted at pure mathematics, with a further sixth of the topics being focused on statistics and probability and the last sixth focused on mechanics. In this aspect it is a very similar balance of topics to the most usual combination of subjects in A level Mathematics.

The need to study a diverse range of mathematics, combined with the different approaches required for both mechanics and statistics serves to raise the level of demand of this qualification.

The range of mathematics studied is very similar to that of A level Mathematics but there are one or two additional topics such as complex numbers which are covered in further mathematics in the A level. The topics fit well together and would allow for both synoptic teaching and learning and assessment.

The qualification is assessed by two three-hour papers at the end of the two years of study. Paper 1 assesses half the pure mathematics content and all of the statistics and probability content. There are 80 marks for pure mathematics and 40 marks for statistics and probability. Paper 2 assesses the other half of the pure mathematics and the mechanics content. The ratio of marks is identical to that of Paper 1.

The papers were found to be more demanding than A level Mathematics based on three factors: first, the inclusion of several topics such as complex numbers which are not on the A level specification; secondly the terminal nature of the examinations

which require all the topics to be tackled within the two papers, with no possibility of re-sitting within the time span of the course; and thirdly there is less scaffolding within the examination questions than there is in the A level.

However, although the papers were judged to be harder than those of A level Mathematics, this may change over time as the qualification matures. The examiners' report for 2010 states that: "it became evident as soon as Paper 1 had been sat, that the level of difficulty might have been too high, and this was confirmed after Paper 2 had been taken" (Cambridge Pre-U).

From June 2012 there will be three papers rather than the previous two. Each paper is allowed two hours and contains 80 marks. The syllabus content, total assessment time and the total marks available are unchanged. Papers 1 and 2 cover the pure mathematics content and Paper 3 the applications of mathematics including probability and mechanics.

5 Findings: Chemistry

5.1 Summary

All of the chemistry qualifications included in this study have similar aims:

- knowledge and understanding of chemical principles
- application of knowledge and understanding
- the importance of practical work and the acquisition of skills of carrying out, recording, analysing and concluding
- an appreciation of the role of chemistry in society.

However the balance between these elements varies between qualifications. There are also differences in the way the aims are targeted or tested by the assessment materials.

Most syllabuses have a core of compulsory content which may be specified in great detail and forms the basis for teaching. The exception is the New Zealand NCEA Level 3 which offers a number of “achievement standards”. These are individual courses which students can complete to accumulate credit towards their final certificate.

There is a wide variation in the number of topics covered within the syllabuses. The content of the OCR A level and the Hong Kong A level Examination (HKALE) is almost identical. The two University of Cambridge International Examinations (CIE) courses and the International Baccalaureate (IB) Diploma Higher course contain a few additional topics; nine syllabuses (including all of their options) contain less than 60 per cent of the topics in OCR A level. Details of the syllabus analysis can be found in Table 3 of the Full Report: Table Supplement.

There is also variation in the depth to which topics are studied. The Cambridge Pre-U has a similar range of topics to the OCR A level but students are expected to study some of these to a level which matches the content in the first year of a chemistry degree course. A number of countries do not go beyond the depth of study in the first year of the OCR course (AS). Others relate more closely to the English GCSE syllabus, the qualification typically taken in preparation for studying courses such as the OCR A level included in this study.

The range and variety of chemistry which a student can study successfully is closely related to their mathematical competence. This can range from plotting experimental results on a graph to the formulation of algebraic equations used in rate calculations and chemical modelling. All syllabuses appear to expect students to be able to carry

out routine arithmetical calculations such as those in stoichiometry and empirical formulae, but the actual requirements are sometimes not defined or not included.

The Denmark STX Chemistry A course specifically requires students to complete the STX Mathematics B course in support of their studies. It does not specify which mathematical knowledge and skills from that course students are expected to apply to chemistry.

Alberta's Chemistry 30 syllabus cross-refers directly to specific objectives within their qualification's Applied and Pure Mathematics 10 and 20 syllabuses. The most detailed requirements are provided for OCR A level and the two CIE courses.

Eight of the other syllabuses offer some optional material. In France this is the "specialism", an extra course which extends their depth of study. Alternatively in Denmark teachers and students are expected to supplement the compulsory content by choosing topics to study more deeply or in different contexts. Most of the others offer a choice from a number of optional topics; however in Finland students can study all five specialised courses if their school and individual study programmes allow.

All qualifications emphasise the importance of practical work as an essential ingredient of chemistry at this level. Some provide very specific time and task allocation; most give examples of expected or recommended practical experiments. The Republic of Ireland syllabus lists 28 practical procedures for students to complete within the Higher level chemistry course. An alternative approach is the IB which emphasises the importance of practical chemistry as an investigation. This includes students carrying out their own investigative project. In contrast the New York State Regents Diploma has a requirement for students to complete minimum laboratory time, but does not specify a practical programme.

All of the qualification providers offer a range of support materials for teachers and students. These often direct users to suitable websites or reference books for further information, some of which have been specifically developed for the course. Only Alberta and the Republic of Korea actually authorise the textbooks which can be used to support their courses.

All syllabuses have some form of course statements or assessment objectives. These may be expressed in terms of content or generic skills which students can learn or will demonstrate. There are marked differences in the way these assessment objectives are then related to the assessment. Some assessments use them as a basis for the assessment criteria used to measure student achievement. Others allocate skills to individual questions. Some do not seem to relate directly to the assessment materials.

Most courses end with a single examination paper. The largest syllabuses, with the most topics and in-depth study, have more papers. The individual examination papers range in timing from the NCEA Level 3 individual achievement standard assessments at 35 to 45 minutes up to the six-hour paper for the Finland Matriculation Examination.

The examination papers reviewed were presented clearly. Most use International Union of Pure and Applied Chemistry (IUPAC) nomenclature and International System of Units (SI units), except the qualifications reviewed from the Netherlands. Questions are generally well presented with appropriate use of language. Diagrams when used are helpful and clear.

A variety of question types are used by all qualifications. This includes multiple-choice and numerical response; short-answer questions; interpretation of data; calculations; evaluation and analysis; interpretation of data and use of graphs; practical procedures and so on.

The nature of the questions reflects the rationale and aims of the course. For example where a course emphasises the acquisition of knowledge, the questions asked can only require recall. Questions are generally short, often heavily structured into multiple parts. Therefore, many students do not have to create a strategy which involves multiple stages to answer questions, except in complex calculations. The exceptions to this are the Denmark STX largely unstructured final assessment and the extended writing task in Hong Kong HKALE Paper 1.

Marking support, where available, is generally clear, providing markers with the detail and definition needed to apply accurate consistent judgements. There are differences between the detailed mark-based schemes used by several qualifications including OCR A level, and the criteria-based approach used by others.

A summary of the key features of the assessments for each education system included in the study and a summary of what each course covers appears in Table 3 and Table 7 of the Full Report Table Supplement.

Content, coverage and depth

All of the syllabuses reviewed intend to build upon students' previous studies in science and other subjects. In general there are no entry conditions set but most syllabuses make recommendations about students' prior learning. This will assist teachers and parents in supporting a student's choice of courses.

The number of chemistry topics covered ranges from around 25 to over 60, but the information is organised and expressed in different ways.

The rationale for the syllabus is generally presented by identifying key concepts or ideas, often in terms of their application. This ranges from the broad unifying

statement provided by the New York State Education Department (NYSED) to the very detailed courses provided for the OCR A level and CIE courses.

Similarly, the course syllabuses vary in length. This is due in part to the detail in which the course content is explained. The Norway *Vitnemål fra den Videregående Skole* and China *Gāokǎo* essentially provide a simple statement of the chemistry students must learn. In France the *baccalauréat général* materials contain highly detailed aims and a preamble to set the scene of the qualification. The HKDSE and Korean CSAT provide historical references explaining the development of the course.

All have common aims integrating the gaining and application of chemical knowledge; demonstration of practical skills and processes; understanding and processing data with broader social, environmental applications to everyday life. However there are differing balances between theory, practice and application both within the syllabuses and in the assessments.

The syllabuses reference the continuation of studies to higher education / university and centre on the development of students who can make a positive contribution to society by being scientifically literate and having enquiring minds. The China *Gāokǎo* focuses on the demonstration and application of knowledge of chemical principles. The Hong Kong HKDSE refers to the importance of science in the pace of change in society and identifies a role in integrating science and technology with increasing appreciation and excitement for students through relevant learning experiences. Norway uniquely integrates the historical development and links to cultural heritage as part of its ethos for a holistic qualification, but in terms of the chemistry course gives little in addition to the content. The Republic of Korea CSAT focuses on the engagement and enjoyment of students in the realisation of the importance and relevance of chemistry to everyday life.

Some syllabuses relate the aims to specific skills. The Denmark STX, Finland Matriculation Examination, Hong Kong HKALE and HKDSE refer explicitly to experimental skills. The STX, HKALE, HKDSE, International Baccalaureate (IB) and the New South Wales HSC also detail the development of personal and communication skills. Others include aims in terms of student attitudes. The China *Gāokǎo*, England OCR A level, Finland Matriculation Examination, Hong Kong HKALE and HKDSE seek to develop student interest in the study of chemistry whilst the Republic of Korea CSAT and NSW HSC frame this in terms of developing positive attitudes towards the study of chemistry. The Alberta Diploma, Finland Matriculation Examination and Republic of Ireland Leaving Certificate refer to the importance of developing knowledge and understanding for students intending to continue with sciences at university. The USA ACT, Republic of Korea CSAT and China *Gāokǎo* are very clear that they are assessment tools to establish students' readiness for college-level work.

The alternative threads reflect the purposes and societal contexts of the qualifications. The Denmark STX and Canada Alberta Diploma syllabuses are driven by more holistic applications and the development of science in support of society; while the Hong Kong HKALE, the Hong Kong HKDSE and Republic of Ireland Leaving Certificate clearly focus on the development of skills for further study or employment. The New South Wales HSC is organised to emphasise skills teaching. The People's Republic of China *Gāokǎo* highlights the applications of chemistry to everyday life and industry; and the Hong Kong HKDSE, one of the newest qualifications included in this study, purposefully integrates links between the sciences, technology, society and environment in each topic to emphasise the relevance and diversity of the subject.

All qualifications have external assessment at the end of the full course of study. Only the OCR A level allows truly modular assessment with examination papers for each unit which can be taken at separate times throughout the course, but only count towards the qualification when all the assessments for AS or A level have been completed. This does not necessarily reduce the opportunities to retake assessments, but it may mean that students must repeat the entire course.

The OCR A level, Hong Kong HKALE and Hong Kong HKDSE, the IB Diploma and both CIE syllabuses have multiple examination papers, dividing the course content into key chemistry topics and their applications. This manages the testing of a wide range of material within the six largest syllabuses, but restricts the opportunity for synoptic assessment. Students are not tested on their ability to combine knowledge from different areas of the syllabus in order to solve a new problem in a different context.

There is a general separation of theoretical and practical skills. This is reflected in the assessment structure, with these skill sets assessed separately in all syllabuses except for the Denmark STX.

The STX provides the only fully integrated externally managed assessment. Students are given a task for which they must conduct an experiment, observe and record their results, before analysing, evaluating and interpreting their results for presentation (orally and in writing) to the examiner.

Outside Denmark school assessment makes variable contributions to the final qualification, but practical work is always assessed by the school. In many cases the tasks, marking criteria and quality control are provided externally.

Those qualifications concerned only with university entrance, USA ACT, Republic of Korea CSAT, Finland Matriculation Examination and People's Republic of China *Gāokǎo*, do not include any practical assessment although the assessment may include questions about experiments. Students in Finland must successfully

complete the school chemistry course, including practical work, before they can take the examination.

The organisation of the assessment burden was seen to be a significant factor. For example, the chemistry section of the People's Republic of Korea CSAT is considerably shorter than other syllabuses with a similar range of topics but it is part of a larger examination where all subjects are examined in one seven-and-a-half-hour day. Students attempting the chemistry papers have already tackled papers on Korean, mathematics and a foreign language plus up to two other sciences. The *Gāokǎo* is only slightly less burdensome, with chemistry, part of the science suite, taken on the morning of the second consecutive day of testing (day 1 tests Chinese and mathematics).

In sharp contrast, OCR A level examinations could be taken months apart across a two-year period. These different approaches must have an impact on examination preparation and the levels of demand and stress for students, as well as the depth and breadth of the chemistry content which can be appropriately assessed.

The Norway *Vitnemål* has a distinct approach with students selected to sit external examinations in only four of their subjects and Norwegian. A student is still assessed, but this is managed within the school and the results are reported centrally.

Regardless of the timing or number of discrete assessments examined, the total duration of the entire assessment burden is typically around three hours. Significant outliers to this are the CSAT in the Republic of Korea at 30 minutes, and seven-and-a-half hours for both the Cambridge Pre-U and the OCR A level.

The syllabuses for upper secondary chemistry included in this study describe courses of varying lengths and structures. However in general all study programmes expect students to spend upwards of 100 hours per year on chemistry. France, with its unique physics–chemistry combination is significantly below this at only 59 hours of chemistry in the final-year course. The OCR A level (180 hours) and the Cambridge Pre-U (190 hours) devote the most time, perhaps reflecting the narrower range of other subjects typically studied.

The organisation of study is also diverse with some education systems offering a range of study programmes or options. The choice is made early in the Netherlands with students following the havo (technical) or vwo (academic) programmes to prepare for higher education from the beginning of secondary school. Other qualifications offer a series of courses, each building on the previous one, towards the level of qualification included in this study. In many cases these earlier courses can result in a qualification at a lower level such as the Republic of Ireland Ordinary, OCR AS level, NCEA Level 1 or 2, and the Denmark STX C or B.

Important differences were identified in how practical work is incorporated into the course. For example, the OCR A level gives less importance to practical skills than the Cambridge Pre-U, the Danish STX or the HKALE where practical skills and testing knowledge of practical skills constitute a high proportion of the assessment materials. By contrast the Republic of Ireland Leaving Certificate only tests knowledge and understanding rather than practical application of experimental work.

There is varying emphasis on the nature of scientific investigation and evidence.

The majority of the courses have very detailed practical approaches, and specify practical work as an essential ingredient of the qualifications. The People's Republic of China *Gāokǎo* devotes one of its five units to the completion of practical work even though this is not assessed. In France the *baccalauréat général* lists required practicals with techniques and skills to be acquired and details of how the necessary skills can be developed and then assessed. This practical assessment (which may be in chemistry and / or physics) contributes up to 20 per cent of the total chemistry–physics score.

The Republic of Korea CSAT syllabus lists suggest practical work and teachers are expected to monitor practical tasks to encourage skill development. However, this makes no contribution to the CSAT score.

The importance of the social applications and implications is central to the STX in Denmark, and to a slightly lesser extent to the Alberta Diploma, whereas it is secondary to the content within the OCR A level and the Leaving Certificate in the Republic of Ireland.

The linking of course material with this concept is very limited in Finland. However a more integrated approach is adopted in the People's Republic of China *Gāokǎo*, the Republic of Korea CSAT, the Hong Kong HKDSE, the Alberta Diploma and the New York State Regents Diploma but they are less clear than that followed by the Republic of Ireland Leaving Certificate (Established). The Danish STX qualification emphasises application with no formal factual recall. This is evidence of a higher-demand requirement, based on the assessment objectives. It also incorporates much more extra-curricular contextualisation through supplementary materials and research. This allows for coverage of topics that may exceed other courses in the recent research and applications of chemistry.

Most qualifications reviewed cover the key ideas and concepts of chemistry but the range, and in particular the depth of study within a topic differs greatly. Although syllabuses generally have an intention to prepare students for university studies, the actual range and depth of study are different. Within syllabuses aspects of physical chemistry tend to dominate the chemistry content with relatively little attention paid to inorganic chemistry.

The Hong Kong HKALE, IB Diploma, OCR A level and the two CIE qualifications have by far the greatest depth and range of content, with the People's Republic of China *Gāokǎo*, Hong Kong HKDSE, Norway *Vitnemål* and Denmark STX fairly close. The Alberta Diploma, Finland Matriculation Examination and New Zealand NCEA Level 3 have the narrowest content. This again mirrors the purpose and cultural context of the qualifications: stand-alone chemistry versus diploma or matriculation contribution. That is, the OCR A level concentrates on the delivery of the chemistry course itself, while the other countries discuss how education can prepare students for life outside secondary school and for a life of learning. The IB Diploma stands in the middle ground, being a diploma-style qualification with excellent content range, but lacking the depth and application of the CIE syllabuses and the OCR A level in particular.

The significant differences in the OCR A level are the inclusion of a number of modern methods of analysis, the greater depth of treatment of rates of reaction and the inclusion of entropy and free energy and their inter-relationship. OCR A level students are taught content outside a context that links it to the real world. The content of OCR A level seems broader and more balanced than the majority of other courses, with content from organic, physical, inorganic and analytical chemistry being studied in similar proportions, and the A2 course developing foundation knowledge from the AS. The closest match on content is the HKALE. However, the range of topics in the other courses is uneven with some key topics absent. For example, the New South Wales HSC and Finland Matriculation Examination do not include benzene chemistry or modern analytical techniques and the Denmark STX makes no mention of transition elements, electrode potentials or polymers.

The breadth of content for the Alberta Diploma is narrower than that of the OCR A level and the depth is substantially less than that defined for A level, being much closer to that which would be expected for AS. However limited the range of topics studied are, they are conceptually amongst the harder topics in the OCR A level.

The Hong Kong HKALE, OCR A level and the CIE syllabuses are content-led with references to the contexts in which chemistry is important. Chemical knowledge and ideas are collected together in traditional groupings which suggests that there is an expectation that major topics will be fully covered before moving on to a different topic rather than re-visiting the topic in several stages. The HKALE has a broad and balanced range of topics similar to that of OCR A level, ensuring a comprehensive coverage of physical, inorganic and organic chemistry together with modern analytical techniques. The chemical kinetics section of the HKALE syllabus includes greater depth and breadth in a number of aspects such as the Arrhenius equation, rate determining step, transition states and energy profile. The equilibrium section includes all of the OCR A level topics and goes beyond with secondary cells, solubility product and partition coefficient. In the section on p-block chemistry the topic of Group IV elements with a focus on silicon and silicates goes beyond the

scope defined for Chemistry A level in England. Similarly, the “Chemistry in action” section of the HKALE syllabus goes beyond the OCR A level by considering a far wider range of synthetic polymers and the effect of structure on their properties; the same section contains a topic on drugs which is also outside the English scope. The Cambridge Pre-U extends the depth of content of some topics even further and for some topics, for example organic mechanisms, takes the content to first-year degree course level.

France uniquely, integrates physics and chemistry concepts into one syllabus (similarly biology is integrated with geology, and geography with history). This mandatory coupling of chemistry with physics, taught as an integrated course, offers options to specialise in one or the other via additional study time. However, as a result, the chemistry content has less depth and range in comparison with other qualifications at this level, reflecting the narrow time allocation provided by the *baccalauréat général*.

The Norway *Vitnemål* takes a similar conceptual approach to the teaching of chemistry as the *baccalauréat général*, and therefore organises topics differently from the stand-alone qualifications such as the OCR A level. The content covers most of the traditional areas of chemistry to a reasonable depth, especially the organic mechanisms. It lacks detailed coverage and depth in physical chemistry topics such as kinetics and equilibrium; and makes little reference to instrumental analysis.

The *Gāokǎo* presents topics which require little quantification and mathematical demand. Optional topics add depth and contextualisation, but because they are optional students miss out on two of three knowledge bases which limits their organic or analytical chemistry knowledge.

Assessment

Students studying the OCR A level would recognise the content of all of the qualifications included in this study, because the topics are included by OCR. However, the depth of study within other qualifications varies and is often contextualised throughout the course. This approach in the Cambridge Pre-U increases the level of difficulty beyond that of the OCR A level.

The content in the Netherlands havo and vwo has similarities with the OCR A level but the courses have a different emphasis. There is more focus on biochemistry and industrial processes, little inorganic chemistry and nothing about energetics. The assessment for vwo would be more challenging for an OCR student because their course does not require as much mental manipulation of complex molecular architecture. This is also the case for the other qualifications incorporating biochemical, industrial and material properties units, for example HKDSE. However the remainder of the vwo assessment and the havo are far more familiar for OCR

students. It is not clear how the demand of the qualification is affected by the number of subjects students are expected to take alongside chemistry within some of the composite qualifications. The New York State Regents Diploma has a lower chemistry demand in terms of content, but this should be balanced by the burden of all the other subject matter required to graduate with a Regents Diploma.

The New Zealand NCEA Level 3 assessment seems more equivalent to the AS course, lacking coverage in several key areas such as rates of reaction. Therefore although the NCEA Level 3 chemistry studied is of a similar standard, the breadth of topics is far narrower than is expected in England for students finishing upper secondary school. There is also a choice of which topics to study and as a result students can miss significant topics. However, the demand is increased if students take the option that includes an individual research project within the NCEA.

Mathematical content

The IB Diploma, Republic of Ireland Leaving Certificate, OCR A level and the CIE syllabuses all have a clearly stated mathematical component that represents an integral part of the course. For the OCR A level and both the CIE syllabuses these are identical and the most demanding seen. In other courses mathematical requirements can be inferred from the topics covered and questions asked in written assessments. In most of the composite qualifications mathematics is a mandatory subject for all students. However, this has a limited match with the demand for mathematics within chemistry assessments. The exception is the Alberta Diploma which clearly cross-refers the mathematical requirements of the chemistry course to the mathematics syllabus.

The mathematical requirement within the Finland Matriculation Examination, Cambridge Pre-U and Netherlands vwo assessments is extremely similar. New Zealand NCEA Level 3 appears to have a lower level of mathematical demand than all other assessments and does not exceed the level of competence required for English GCSE mathematics.

The demand to be able to use, for example, logarithms in pH calculations is the same for the NCEA as for the Alberta Diploma and the OCR A level, but there is a limited depth of use of mathematics in NCEA assessments. The remaining syllabuses rely much more on students learning the relevant material and being able to apply it in relatively simple cases. The difficulty of calculations tends to follow the same pattern as the range and depth of topics in the syllabus. Most composite qualifications present mathematically undemanding assessments. The exception is once again the IB Diploma with the wider range of content requiring more mathematics.

Students are allowed to use calculators within the assessment, with specific exceptions, for example the IB Diploma Paper 1 objective test.

The impact of mathematics upon the demand of the assessment can also be measured in terms of the proportion of the assessment which relies upon correct application of mathematical techniques and skills in support of chemical knowledge, understanding, application and skills in order to complete a task or questions. This is highest in the Denmark STX assessment at nearly half of the available marks, but unsurprising given the intensely investigative nature of the assessment. Lowest is the USA ACT which has no mathematical requirements in the science test, but does also test mathematics separately. The Regents Diploma is dependent on mathematics for less than 10 per cent of the assessment, but the remainder are grouped between 15 per cent and 30 per cent. This suggests a clear focus on chemistry, although it may also reflect the prevalence of short-answer questions rather than unstructured tasks.

5.2 Chemistry findings by education system

Australia – New South Wales Higher School Certificate, or HSC

The Higher School Certificate (HSC) in New South Wales (NSW) is designed to be studied by the full range of students, rather than only those planning to continue chemistry at university. Chemistry is an optional subject within the HSC. Taking the HSC chemistry course uses about 20 per cent of the HSC course time because a student typically studies HSC courses in five subjects. In England a typical student takes three A levels using about 30 per cent of their course time per subject.

The syllabus emphasises the importance of chemical education in “developing understanding of and about chemical reactions and processes, the history, nature, and practice, implications and applications of chemistry for society and the environment” (Higher School Certificate assessment materials).

The syllabus is context-led, with chemical knowledge and ideas collected together in themed sections within modules. The majority of topics form the core syllabus, with a variety of options available. Some topics are not covered to a significant depth, and concepts such as some aspects of quantitative chemistry and analytical techniques are not included or are limited in use.

The course materials do not provide an overview of the mathematical content; however, within the syllabus it is clear that a sound if limited knowledge of skills in mathematics is required throughout the course.

There is a choice from five options in the HSC course which are contextual in nature. This allows students to show their chemistry knowledge and the application of their skills. The options provide a natural extension of the core learning, have an attractive balance and are written to the same depth of treatment. This means that not all content is covered by all students, but the syllabus also presents some option topics, for example biochemistry, not normally found in chemistry courses at this level.

The HSC is one of very few qualifications offering significant options as a feature of the course. If fully available these options enable choice of content to match individual student interests. Including all the option topics the syllabus covers around two-thirds of the topics included in the OCR A level syllabus.

The practical programme is extensive, set at a minimum of 80 hours (a third of the teaching time) across the two courses. Students are expected to acquire a wide variety of skills and knowledge. There is a clear focus on developing investigative skills throughout the courses and most notably the completion of an open-ended investigation.

The Board of Studies NSW provides support documentation for teachers and students via its website[12]. For example, the syllabus includes a limited glossary clarifying some terminology and an Appendix with a biochemical pathways flowchart. A support document provides advice to assist teachers' development of skills in teaching, learning and assessment strategies. There is also a draft sample learning unit for chemistry. The Board of Studies NSW does not endorse textbooks.

The HSC assessment objectives are very detailed and cover a broad range of chemistry topics. The assessment materials are very clearly structured and questions describe what is required in detail. The examination mapping grid matches question parts to syllabus content and outcomes demonstrating that the examination covers approximately 90 per cent of the content and therefore matches the assessment objectives. However the assessments lack breadth when compared with the OCR A level, reflecting the smaller number of topics covered in the syllabus.

The multiple-choice questions within the assessments are comparable with the English GCSE. The short-answer questions largely require factual recall from the syllabus but also require students to interpret the questions asked, then devise and deliver an appropriate response. Most questions are straightforward but a few are likely to stretch higher-attaining students. The time allocation seems appropriate for the number of questions to be answered.

Around 20 per cent of the assessment relies upon mathematics, use of graphs, and so on.

Marking guidelines are provided for the HSC examination which indicate the criteria used when awarding marks rather than a detailed mark allocation. Sample answers are also available for two of the three sections of the written paper. The information is comprehensive and detailed, including expected answers as well as other acceptable responses. The table format is very easy to follow. However it is not clear how much

[12] www.boardofstudies.nsw.edu.au (accessed on 15th May 2012).

of an answer is required to satisfy each level of the marking criteria. The sample answers themselves would be helpful for teachers and students preparing for the examination.

Canada – Alberta Diploma

The Alberta Diploma is designed to be studied by the full range of students, rather than only those planning to continue chemistry at university. Chemistry is an optional subject within the Alberta Diploma. Taking Chemistry 20 and 30 courses within the diploma programme uses about 15 per cent of the Alberta Diploma course time. In England a typical student takes three A levels using about 30 per cent of their course time per subject.

The Alberta Diploma syllabus has an aspirational set of goals, including the encouragement of students "to develop a critical sense of wonder and curiosity about scientific and technological endeavour" (Alberta Diploma assessment materials). Consideration is given to enabling students to acquire new knowledge and to address critically science-related societal, economic, ethical and environmental issues. This includes reference to scientific literacy and aims to present science in a meaningful context. The full Alberta Diploma curriculum is highly integrated with chemistry specifically linked to earlier science and mathematics course content and to mathematical topics studied alongside chemistry at this level.

The syllabus identifies unit titles and provides specific content detail including focusing questions, key concepts and outcomes. Detailed performance descriptors for "acceptable standard" and "standard of excellence" are given for the internal assessment of student progress throughout the course, which includes communication, practical and knowledge skills. However the diploma syllabus makes no reference to the periodic table and lacks a simple qualitative treatment of rates of reaction. This is unusual in comparison with the other qualifications considered for this study. It covers around a third of the topics included in the OCR A level syllabus and therefore lacks exposure to some topics and analytical techniques.

There are links to specific mathematical units which include linear mathematical calculations and graphical skills. However, when in kinetics calculations such as pH and pOH from K_a are required there is no mention of using a graphical method.

There are performance criteria which define the expected investigative and practical skills, and each unit contains a list of relevant experiments as "an illustration of how the outcomes might be developed" (Alberta Diploma assessment materials).

Alberta Education provides support documentation for teachers and students via its website[13]. This includes exemplar questions and an authorised resources database

[13] www.education.alberta.ca (accessed on 15th May 2012).

which details appropriate textbooks, DVD / online courses and other support materials.

Many of the multiple-choice questions require simple recall from the syllabus, logic and analysis or recognition of simple organic species, with very little opportunity to test higher-order thinking skills. The test also includes innovative numerical response questions in which students solve problems by identifying relevant data and independently processing two or three steps to formulate a numerical response. The examination is machine-marked.

Less than 15 per cent of the assessment relies upon mathematics, use of graphs, and so on.

Denmark – *Studentereksamen*, or STX (Upper Secondary School Examination)

The *Studentereksamen* (STX) is designed to be studied by students intending to continue their academic studies at university. Students must do well in their lower secondary courses in order to be accepted for STX. Students must pick two subjects from biology, chemistry and physical geography as part of their studies. The chemistry courses build upon the knowledge, understanding and skills developed by students earlier in school. Taking Chemistry A, B and C courses within the STX uses about 15 per cent of a student's STX course time. In England a typical student takes three A levels using about 30 per cent of their course time per subject.

Aims for chemistry within the Danish STX qualification go beyond the straightforward development of chemistry knowledge and skills. Students are specifically required to consider chemistry in a wider context of other subjects. This is reflected in the curriculum for all subjects.

The syllabus sets out academic aims which cover communication, calculation, applications of knowledge and links between concepts as well as chemical knowledge.

The syllabus is highly contextualised and sets out a complex system of study. The core material is described in terms of theoretical knowledge and ideas to be delivered in themed stages. The range of topics covered is very similar to the OCR A level syllabus.

The syllabus does not provide an overview of the mathematical content. However students are required to study the Mathematics B course in support of Chemistry A and success in the assessments requires good mathematical skills.

There is no formal choice of options within the Denmark STX course. However teachers, with their students, are expected to select and use additional materials outside the defined syllabus. The purpose of this additional material is defined for each course; broadly this is to develop students' understanding of chemistry as part

of daily life and in current debates. STX Chemistry A is the only qualification considered as part of this study which includes study of recent chemical research and developments. This additional material provides the opportunity for all students to demonstrate their full capabilities.

There is a strong emphasis on practical work with teachers encouraged to demonstrate chemical processes rather than rely upon textbooks. Students are expected to acquire a wide variety of skills and knowledge. There is a clear focus on developing investigative skills throughout the courses. Schools are also expected to provide opportunities for students to use sophisticated technical equipment either in school or by arranging visits to external laboratories.

The Danish Ministry of Children and Education provides support documentation for teachers and students via its website[14]. For example the syllabus guide includes suggested approaches for teaching and assessing the course. There are also detailed support materials for the final examination, including exemplar student responses with examiner comments. Laboratory courses are organised centrally to prepare students for the final examination.

Each school must submit their assessment strategy to the Ministry of Children and Education and publish it on the school website. The school is then expected to assess and report a student's achievement across the whole of the syllabus in line with their strategy documents. The frequency and type of assessments is defined in the general curriculum documents published by the Ministry. The Ministry decides by lots if the assessment for a particular class will be written or oral.

For the oral examination each student chooses one task at random. The tasks are issued to test centres from a bank held by the Ministry. The requirement of students is to interpret the task set, carry out the necessary research during the two hours of laboratory time, then devise and deliver a detailed logical response. This problem-solving and practical approach to assessment is completely different from that of the English A level.

Over 45 per cent of the assessment relies upon mathematics, use of graphs, and so on. This is the highest proportion found in any of the qualifications included in this study.

No mark scheme is provided for the STX and there are no mark allocations on the task materials given to students. The examiners observe the students carrying out the task and mark them against the academic goals of the STX which include communication, calculation, applications of knowledge and links between concepts.

[14] http://eng.uvm.dk (accessed on 15th May 2012).

The emphasis is on whether the student is able to use their chemical knowledge to solve new problems and produce a written explanation, using mathematical equations and chemical formulae to demonstrate how they reached their conclusions.

England – A levels

The A level is designed to be studied by students who were successful in level 2 sciences and wish to continue their studies, although not necessarily to study chemistry at university. After completing half the course, students may claim a qualification called the AS level, with the second half of the course being called A2. Together they make up the A level. A levels are offered by five different organisations in England, and they contain some variation although they are based on a common set of criteria set by the regulator. Chemistry is a subject choice within A levels. This study considered the course offered by OCR. Taking chemistry A level typically uses about 30 per cent of a student's A level course time.

The OCR A level syllabus aims to encourage students to: develop their interest in, and enthusiasm for chemistry, including developing an interest in further study and careers in chemistry; appreciate how society makes decisions about scientific issues and how the sciences contribute to the success of the economy and society; develop essential knowledge and understanding of different areas of chemistry and how they relate to each other.

The syllabus is highly prescriptive of content but allows some flexibility of teaching order. The materials are functional, detailed and supportive and pick out key areas of course design that can be used by schools in constructing their course. There are sections which require a higher level of understanding of chemistry, for example Boltzmann distribution, redox potentials, and mathematical relationships involving entropy and free energy. This syllabus covers one of the broadest ranges of topics in comparison with the other qualifications considered for this study. All topics are covered in depth.

Details about the range of mathematical skills that are needed to support the study of chemistry are stated to enable students and their teachers to know with some precision what is expected of them.

The practical programme is specified in the syllabus, including the identification of the three different types of practical skills and ideas for practical work. The level of detail provided and the use of separate practical assessments to test specific skills is unique within the qualifications considered for this study.

OCR provides a full range of support materials through its website[15]. This includes the specification document with a full description of all the requirements of the qualification, past papers with mark schemes and examiners' reports. OCR also offers training seminars for teachers.

OCR offers textbooks and revision guides for some subjects in association with a publishing house, but currently only an AS revision guide is available for chemistry.

The OCR A level syllabus details three assessment outcomes covering recall, application and evaluative skills. The assessment requires students to have a good knowledge and understanding of the syllabus material. At assessment level, the OCR A level is by far the more complex assessment model, comprises most units and examinations, and is the only specification to use a modular approach. Each assessment focuses on a specific topic, giving limited opportunity to link large chemistry ideas across topics, especially in the AS (first year). However, there is opportunity for students to demonstrate a considerable depth of knowledge.

OCR provides set tasks and detailed guidance for their use in the internal assessment of practical work. The assessment is marked by teachers using OCR mark schemes, and marked student work is sampled by OCR to ensure consistency.

The written papers contain a wide variety question types which contain an appropriate level of information to support the student. Questions are structured giving students direction, facilitating recall, and arguably reducing analysis or synthesis particularly for single-word or number answers. The relatively short time allowed may be insufficient for some students to demonstrate the range of skills needed. However students are able to use past papers as preparation and learn to use their time appropriately.

Less than 20 per cent of the assessment relies upon mathematics, use of graphs, and so on.

Students may retake all modules including practical skills tests.

The mark schemes provide clear instructions including significant detail on what to accept, ignore and not accept. Marks are clearly allocated to questions including possible alternative correct chemistry. The guidance contains comments to ensure consistency and precision in marking.

[15] www.ocr.org.uk (accessed on 15th May 2012).

Finland – *Ylioppilastutkinto* or *Studentexamen* (Matriculation Examination)

The Matriculation Examination is designed to test students' level of achievement in their upper secondary studies. An overall pass entitles them to continue their studies at university. Chemistry is an optional subject. Taking both the compulsory and specialised additional chemistry courses within the upper secondary school programme uses about 10 per cent of a student's Matriculation Examination course time. In England a typical student takes three A levels using about 30 per cent of their course time per subject.

The upper secondary syllabus emphasises the importance of chemistry in supporting the development of students' scientific thinking and modern world view as part of an all-round education. It describes chemistry as one of the key natural sciences, which studies and develops materials, products, methods and processes in order to promote sustainable development. The overall goal is that instruction will help students to understand everyday life, nature and technology and the significance of chemistry to the well-being of humankind and nature.

The focus of chemistry in upper secondary is application and the subject content is described in themed groups of topics. Each group includes references to the applications and environmental impact of chemistry and a brief list of core content. Teachers are encouraged to develop the students' depth of knowledge and to teach them to apply this knowledge in unique situations.

The syllabus does not provide an overview of the mathematical content.

There are five specialised chemistry courses which students may choose to study in addition to the compulsory course on the chemistry of man and of the living environment. This allows students to develop a much wider knowledge of chemistry and the application of their skills. The specialised courses extend considerably the coverage of topics available to students and are presented in the same format and level of detail. This means that not all content is covered by all students and will restrict their choices in the Matriculation Examination.

The Matriculation Examination is one of very few qualifications in this study offering significant options as part of the syllabus, although it is not clear whether student choice is in fact limited by their school's choice of courses. If fully available these options enable a choice of content to develop students' knowledge. However overall the syllabus, including specialisms, covers about half of the topics included in the OCR A level syllabus. A practical programme is included in the syllabus but there does not appear to be a practical element to the Matriculation Examination.

Support materials for students and teachers are provided by the Finnish National Board of Education. The Finnish National Board of Education and the Ministry of Education and Culture do not endorse textbooks.

No separate assessment objectives are given for the Matriculation Examination. The upper secondary syllabus does give concise generic assessment objectives relating to knowledge and understanding, application of knowledge and experimental work. However these refer to the school assessment during and at the end of courses rather than the Matriculation Examination.

In the Matriculation Examination, students can choose any six questions from the 12 on the paper, including the two with higher scores. In practice their choices are limited by their choice of courses. The questions are short and the language is very clear; however students are not given any guided instructions as to the content of their answers. The questions make little use of scaffolding and often require students to link together chemistry concepts from different areas although sometimes within a limited context. The questions require students to demonstrate they can apply their knowledge and understanding.

Nearly 30 per cent of the assessment relies upon mathematics, use of graphs, and so on.

The marking criteria for general studies assessment, which includes chemistry, are available on the Matriculation Examination Board (or Ylioppilastutkintolautakunta) website[16]. These describe the general features of good and poor work and refer to an assessment scale which should be used to allocate the score to each question.

France – *baccalauréat général*

The *baccalauréat général* is designed to be studied by students who have been successful in the *diplôme national du brevet* and who plan to continue their studies at university. Taking both compulsory and specialisation courses for the joint subject of physics–chemistry within the *baccalauréat général série* S uses about 20 per cent of the *baccalauréat général* course time. Study load within the course is split between physics and chemistry. In England a typical student takes three A levels using about 30 per cent of their course time per subject.

In *série* L chemistry is a minor part of the scientific course (*enseignment scientifique*) which has topics focused on water, foods and energy. No student graduating from *série* L can choose to study science in higher education. This syllabus was judged to be significantly below the demand of the OCR A level.

In *série* S chemistry is paired with physics as one of the optional science subject courses and this limits both the amount of material and time for the chemistry course. Even within the scientific programme, the student's achievement in chemistry has a very limited impact upon their overall score (a weighted average).

[16] www.ylioppilastutkinto.fi/en/index.html (accessed on 15th May 2012).

The syllabus is conceptual, built on a generic understanding of chemical transformation exploring how chemists work (analysis and synthesis) and how chemical systems develop from an initial state to an end state. For example kinetics and thermodynamics are touched qualitatively via the development of a chemical system from experiments, observations and measurements. This approach combines usually separate topics such as electrochemistry with acids and bases into one.

The *baccalauréat général* syllabus does not offer options within the physics–chemistry course, but students can choose physics–chemistry as a specialism, which extends their studies and increases the weighting given to the subject marks in their overall score. Including the specialisms and some items from the physics courses the syllabus includes up to two-thirds of the topics included in the OCR A level syllabus.

The practical programme is a significant feature of the syllabus with two hours every two weeks for all students and an extra two hours per week for science specialism courses. Students are expected to discover, absorb, apply and internalise laws, techniques, procedures and the way of thinking, to acquire different experimental skills.

Support is provided to teachers and students through the Eduscol website[17]. French legislation protects the academic freedom of teachers to design their courses to meet the syllabus requirements, using whichever resources and textbooks they choose. In addition, all teachers in French schools are involved with the delivery and marking of national examinations in their region which provides opportunities for them to develop their knowledge of assessment and good practice.

For the national examination, there is a written test in physics and chemistry and a practical test. Practical skills are assessed in a one-hour practical examination. The assessment tasks are prepared centrally and a selection is made available to schools each year.

Teachers are provided with an assessment grid and guidance to help them mark student performance out of four marks. The mark given covers the student's experimental capacities, the results of their experiment and their written report.

Hong Kong Advanced Level Examination, or HKALE

The HKALE is designed to be studied by students who have been successful in Hong Kong Certificate of Education Examinations sciences and wish to continue their studies although not necessarily to study chemistry at university. Chemistry is an optional subject. A typical student taking Chemistry A level alongside four AS

[17] http://eduscol.education.fr (accessed on 15th May 2012).

subjects uses about 30 per cent of their study time for the A level. In England a typical student takes three A levels, also using about 30 per cent of their study time per subject.

The syllabus aims to include the integration of chemistry into daily life and an awareness of the impacts of chemistry. This includes problem-solving skills for scientific investigation and communication; pattern recognition and practical skills.

Some of the topic titles in the syllabus are familiar chemistry (bonding and structure, energetics and so on) with good detail and depth.

While no specific mathematical content is given in the syllabus, manipulating data and performing calculations is one of the ten assessment objectives within the HKALE. However, most calculations are straightforward except for the calculations of K_{sp} and application of the Arrhenius equation to determine activation energy.

All HKALE syllabus topics are core and therefore there are no optional topics to be studied. Overall it covers a very similar range of topics to those included in the OCR A level syllabus.

The syllabus specifies the practical skills and minimum number of experiments to be completed. The HKALE relies upon continuous assessment of practical work by teachers to evaluate a student's ability to plan experiments, carry them out and use the results to reach a conclusion. The marks given by teachers are externally moderated.

The HKALE assessment objectives cover knowledge, comprehension, application and analysis / synthesis / evaluation. The syllabus topics can appear on either of the examination papers, rather than being allocated to a particular paper. This is different from the other multi-paper assessments in other qualifications included in this study, OCR A level, the Cambridge International A level and Cambridge Pre-U, which allocate specific topics to particular papers. The questions are mapped against the general syllabus content and the assessment objectives to ensure each question paper provides a broad range of coverage.

The two papers have a similar format although there is an extended writing question worth 20 per cent of the marks in Paper 1. These papers contain the most varied types of question and have a higher sustained level of demand than all other qualifications included in this study. Many questions require higher-level thinking and the ability to link ideas together, often without any scaffolding. However, questions are clear and precise, ensuring students understand what they need to do and how the marks are awarded.

The time allocation is reasonable given the demand in the question papers.

Less than 15 per cent of the assessment relies upon mathematics, use of graphs, and so on.

Comprehensive, detailed and precise mark schemes including half-marks to recognise fine detail are provided for the written papers. These do not include the scope for alternative answers. Considerable detail is provided in the mark scheme for essay questions providing very valuable support for markers. There are marks for the organisation and presentation of information as well as the demonstration of chemical knowledge. Markers are expected to use their professional judgement to consider alternative responses for the extended essay.

The last generally available HKALE examinations took place in April 2012.

Hong Kong Diploma of Secondary Education, or HKDSE

The HKDSE is designed to be studied by the full range of students, rather than only those planning to continue chemistry at university. Chemistry is an optional subject.

The chemistry syllabus is built around ten holistic learning aims with explicit links to the real world; scientific investigation; and the relationships between science, technology, society and environment (STSE). Taking chemistry within the diploma uses 10 per cent of the HKDSE course time. In England a typical student takes three A levels using about 30 per cent of the course time per subject.

The course is organised in such a way that modules can be run at different times to better allow teachers to introduce topics in a natural way. The three-year senior secondary course comprises 12 compulsory modules providing a range of topics similar to the OCR A level. All major fields of chemistry are well represented giving a strong foundation (namely physical chemistry, organic chemistry and inorganic chemistry).

There is a choice for teachers or schools to select two from three optional subjects. Students will then be able to select the appropriate question option during the examination. The optional topics: industrial, materials and analytical chemistry, extend the core content and provide depth and context for the students. The options also cover the key modern approach of green chemistry, and some limited chemistry of biologically important molecules. Including all the optional topics the syllabus covers a very similar range of topics to the OCR A level syllabus.

The syllabus includes a number of practical activities, for which there are specific guidelines and an investigative project to support group-working skills.

The HKDSE is a new qualification which students will complete for the first time in 2012. A large amount of support material has been produced including, for example, several suggested module schemes which encourage a more developmental and natural approach which allows linking of topics. The syllabus also gives many

suggestions for contextualising all aspects of the course, with ideas for demonstrations, activities and practical tasks, all relating to the real-world application of chemistry with material that is accessible to students.

The assessment objectives show the different levels of understanding that the students need, not just to recall knowledge but also to evaluate, analyse and apply. Practical work is important in the HKDSE and is included as part of the school-based assessment (SBA) worth 20 per cent of the final score. SBA is a key feature of the HKDSE ensuring subject teachers use the teaching and learning process to support student progress.

The first HKDSE examinations will be taken in April 2012.

International Baccalaureate Diploma

The International Baccalaureate (IB) Diploma programme is designed to prepare students to continue their academic studies at university. Chemistry is a subject choice within group 4, experimental sciences. Taking higher level chemistry within the diploma uses about 20 per cent of the IB Diploma course time. In England a typical student takes three A levels using about 30 per cent of the course time per subject.

The syllabus is very detailed and provides specific objectives; guidance on teaching strategies and delivery time; and, some support in delivering new aspects of the subject content or new topics.

There is a choice of two from seven options within the IB Diploma course. Educational institutions can choose from a range of modern topics such as medicines and drugs; chemistry in industry and technology; and environmental chemistry. These options enable schools to make a choice of content to match local circumstances or teacher specialisms. The higher-level syllabus, including all the options, covers the widest range of topics seen in any of the qualifications included in this study.

A limited range of mathematical requirements are given in the syllabus.

Within the IB Diploma, practical work is assessed by conducting a series of investigations together with a project using generic criteria which require higher-order skills to design, conclude and evaluate findings.

The IB Diploma syllabus details four assessment objectives covering knowledge and understanding; application; analysis and evaluation; and investigative and personal skills.

The IB Diploma examination papers use a wide range of question types. Students are not allowed to use a calculator in the multiple-choice Paper 1. The style of

questions in the other papers is similar to OCR A level, but there is little opportunity for students to make an extended response. The style of the question papers may limit the opportunities for more able students to demonstrate the extent of their knowledge and skills.

Less than 15 per cent of the assessment relies upon mathematics, use of graphs, and so on.

Netherlands – *hoger algemeen voortgezet onderwijs*, or havo

The *hoger algemeen voortgezet onderwijs* (havo) programme is designed for students intending to continue their studies in technical subjects at higher education institutions. Chemistry is a subject choice and students intending to continue their studies in chemistry will normally take the nature and technology specialism. Taking chemistry within the havo programme uses about 15 per cent of the havo course time. In England a typical student takes three A levels using about 30 per cent of the course time per subject.

The syllabus details the topics to be taught in terms of knowledge and understanding or application. This includes non-chemistry content in problem-solving, using ICT and scientific research skills. There is an emphasis on biochemistry and industrial processes, with little inorganic chemistry and no energetics content. The havo syllabus covers over half of the topics included in the OCR A level syllabus although some of the material is only at the level included in the English GCSE specification (Bronsted–Lowry theory of acids, and so on; treatment of equilibrium; and production of ammonia).

The syllabus provides clear mathematical requirements defined in chemistry contexts.

The syllabus encourages teachers to use practical work and experimental research together with demonstration experiments in teaching and assessing students. However there is no practical assessment in the external havo assessment.

The Ministry of Education, Culture and Science provides materials to support schools in developing their own study and assessment programmes. These are subject to quality control by the Dutch Inspectorate of Education. Textbooks are not endorsed by the Ministry or the Inspectorate.

Assessment objectives are not clearly defined within the havo materials, perhaps because the central examination has a different focus each year. The papers are very straightforward and accessible with no options. The questions are organised and presented as themes with stimulus material followed by a number of questions requiring short answers.

The questions are heavily contextualised which often requires a great deal of information to be assimilated before attempting the question. However they also provide guidance and specific information, for example formulae, to support the student. The questions are often relatively straightforward even though the examinations do not use SI units.

The calculations are often the most difficult part of the answer. Over 20 per cent of the assessment relies upon mathematics, use of graphs, and so on.

Successful students can choose to study for an extra year to convert their qualification to a vwo equivalent accepted for academic courses of study at Dutch universities.

Netherlands – *voorbereidend wetenschappelijk onderwijs*, or vwo

The *voorbereidend wetenschappelijk onderwijs* (vwo) programme is designed for students intending to continue their academic studies at university. Chemistry is a subject choice and students intending to continue their studies in chemistry will normally take the nature and technology specialism. Taking chemistry within the vwo programme uses about 15 per cent of the vwo course time. In England a typical student takes three A levels using about 30 per cent of the course time per subject.

The syllabus details the topics to be taught in terms of knowledge and understanding or application. This includes non-chemistry content in problem-solving, using ICT and scientific research skills. The topics appear very traditional but there is an emphasis on biochemistry and industrial processes, with little inorganic chemistry and no energetics content. The vwo syllabus covers over half of the topics included in the OCR A level syllabus, but at a higher level than the havo.

The syllabus provides clear mathematical requirements defined in chemistry contexts.

The syllabus encourages teachers to use practical work and experimental research together with demonstration experiments in teaching and assessing students. However there is no practical assessment in the external vwo assessment.

The Ministry of Education, Culture and Science provides materials to support schools in developing their own study and assessment programmes. These are subject to quality control by the Dutch Inspectorate of Education.

Textbooks are not endorsed by the Ministry or the Inspectorate.

Assessment objectives are not clearly defined within the vwo materials, perhaps because the central examination has a different focus each year. For example the assessment provided for this study was on biochemical contexts. The papers are very straightforward and accessible with no options. The questions are organised

and presented as themes, for example alcohol intolerance, with stimulus material followed by a number of questions requiring short answers.

The questions are heavily contextualised which often requires a great deal of detailed information to be assimilated before attempting the question. However they also provide guidance and specific information, for example formulae, to support the student. The questions are often relatively straightforward even though the examinations do not use SI units.

The calculations were often the most difficult part of the answer. Over 25 per cent of the assessment relies upon mathematics, use of graphs, and so on.

New Zealand – National Certificate of Educational Achievement, or NCEA Level 3

The National Certificate of Educational Achievement (NCEA) Level 3 is designed to be accessible to the full range of students rather than only those planning to continue their studies at university. The senior secondary chemistry courses are part of the wider New Zealand science curriculum and chemistry is a subject choice within a student's study towards their NCEA. Taking NCEA Level 3 chemistry uses about 20 per cent of the NCEA course time, because a student typically studies five subjects. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The science curriculum documents encourage students to study chemistry in order to understand both the world around them and how chemistry can be used to solve technological and environmental problems.

Chemistry is an optional subject in the NCEA and there is a range of courses which can be followed at each level. Within each level there are both content-derived courses of study and an independent chemistry research / practical investigation. The courses build upon specific courses in the previous level, but do not necessarily relate to other courses on the same level. Some topics have a similar breadth to the OCR A level but no topics are covered to the same depth. For example the organic chemistry course lacks any reference to mechanisms, modern analytical techniques and benzene chemistry; instead the work is mainly descriptive involving the recall of aliphatic chemistry and limited deductive analysis. There is some mathematics represented in the NCEA Level 3 course but overall the mathematics required is limited and often practical tasks tell students what data to collect and how to manipulate it.

The NCEA is one of very few syllabuses offering significant options as a feature of the chemistry course, although student choice is limited by their school's choice of courses. These options do enable choice of content to match individual student interests.

The practical programme consists mainly of analytical techniques, especially titrations. Students studying the internally assessed courses have more opportunities to develop their practical and experimental skills. The open-ended investigation which allows students to design and carry out their own experiments in support of a research project may be particularly demanding. This assignment also requires production of a report, which is potentially of greater demand than the practical assessments in the other qualifications included in this study. The skills developed in this part of the certificate are valuable and develop student's analytical and independent research skills.

The New Zealand Ministry of Education provides a wide range of support materials for teachers and students through the website of the New Zealand Qualifications Authority[18] and other related organisations.

There is an achievement standard for each course of study which explains what knowledge, understanding, skills and applications the students are expected to demonstrate. Questions are clearly worded, without context, and include all the necessary information. It is clear what students are required to do.

The majority of questions in the external examinations are recall-based or allow for very limited application / investigation by students. However the extended open response sections do allow students to show what they know about the topic. The time limits for individual papers are short by comparison with other qualifications included in this study which reflects the narrow range of content within each course.

Over 20 per cent of the assessment relies upon the use of very basic mathematics, use of graphs, and so on.

Marking guidelines are provided for the NCEA examinations which give sample answers for each question part. The guidelines define how much of the answer a student must get right for an Achievement (A), Achievement with Merit (M) and Achievement with Excellence (E). There is a specific method for converting the combination of A, M and E within each question into an overall grade for the paper. The sample answers are very helpful for teachers and students preparing for future examinations.

The ministry has introduced a new curriculum for schools in 2010, which has resulted in a re-alignment of the NCEA achievement standards across all three levels. These will be implemented fully in 2013 with new standards at NCEA Level 3. The analysis and findings in this study are based on the outgoing standards which will be examined for the last time in 2012.

[18] www.nzqa.govt.nz (accessed on 15th May 2012).

Norway – *Vitnemål fra den Videregående Skole* (Certificate of Upper Secondary Education)

The *Vitnemål fra den Videregående Skole* (Certificate of Upper Secondary Education) general studies programme is designed to be studied by the full range of students, rather than only those planning to continue chemistry at university. It is an optional subject. Taking both Chemistry 1 and Chemistry 2 courses within the upper secondary school programme uses about 10 per cent of the *Vitnemål* course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The syllabus aims to create interest in chemistry and natural science, and at the same time provide the knowledge necessary for participating in current debate by providing insight into the significance of chemistry and its various applications in everyday life and society. The overall goals are for students to learn natural science concepts and scientific working methods, and how to assess their own work and results.

The syllabus takes a different approach with the organisation of topics into subject areas, each with a clear application. The syllabus specifically relates topics to chemical language and models, experimental methods, current research and chemical analysis. The courses cover organic, analytical and biological chemistry in depth. However, there is limited content for kinetics and equilibrium. The syllabus provides more detail for topics relevant in the real world and for practical research. The range of topics covers about 80 per cent of the OCR A level syllabus and the inorganic chemistry is limited compared with other qualifications included in this study.

The syllabus provides an overview of the mathematical content. Students are expected to carry out calculations, use and interpret formulas, models and data, and solve equations.

The syllabus states clearly that studying chemistry requires linking theory with practical work. It also encourages teaching outside the school, in laboratories and companies, to provide an insight into how chemistry is put to practical use in society. Seven of the ten subject areas across both courses specifically require students to carry out practical work, and this is the main focus of both methods and experimentation in Chemistry 1 and analysis in Chemistry 2.

Not all students who complete Chemistry 1 and Chemistry 2 courses will be required to sit the external examinations.

Over 20 per cent of the assessment relies upon the use of mathematics, use of graphs, and so on.

People's Republic of China – *Gāokǎo* (National Higher Education Entrance Examination)

The *Gāokǎo* is designed to select students for study at the universities of the People's Republic of China and other higher education institutions. The *Gāokǎo* is taken by students after they have successfully completed senior secondary education. Chemistry is one of the three subjects within the science syllabus.

The syllabus document provided contained little detail compared with others reviewed as part of this study. Students are required to learn chemistry facts and knowledge but also to study the interrelations between ideas and the integrated use of knowledge. Throughout the syllabus chemical ideas and knowledge are connected with manufacturing, agriculture and the Chinese economy. This level of application is unusual in comparison with the other qualifications considered for this study.

Mathematics is taken as a compulsory examination within the *Gāokǎo*. Within chemistry students tackle simple calculations of mole or pH, and simple Hess's Law calculations. There are no mathematical requirements defined for the treatment of equilibrium, something which is expected within A level.

There is a choice from three options in the *Gāokǎo*. This part of the syllabus is much more detailed and appears to give the students an opportunity to be examined in an area of their strength.

If all the optional content is included the range of topics is very similar to the OCR A level syllabus. However the options may mean that students do not cover all topics.

The practical programme is part of the compulsory syllabus. Students are expected to demonstrate knowledge of chemical experimental practice, chemical hazards, separations, solution preparation, purification, how to set up apparatus and chemical data analysis. However, students do not complete any practical assessment in the examination.

The National Education Examinations Authority (NEEA) provides syllabus documentation through its website[19] and both students and teachers can obtain further information about particular examinations from the provincial examination authorities.

Less than 25 per cent of the assessment relies upon mathematics, use of graphs, and so on.

[19] www.neea.edu.cn/buttom/english.htm (accessed on 15th May 2012).

Republic of Ireland – Leaving Certificate (Established)

The Leaving Certificate (Established) is designed to be studied by the full range of students in the senior cycle (upper secondary), rather than only those planning to continue their studies at university. Chemistry is an optional subject. Taking higher level chemistry within the Leaving Certificate uses about 20 per cent of the Leaving Certificate course time because a student typically studies five subjects. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The higher level syllabus would normally be studied by students expecting to continue their studies in higher education. It includes both the study of chemistry and the associated skills together with developing an appreciation of the significance of chemistry in personal, social, environmental, economic and technological contexts.

The syllabus is content-driven with a range of topics, although some offer limited depth of study. However the core content includes the additional topic of environmental chemistry: water which expands the ideas of chemical equilibrium and pH.

Mathematical skills are listed in the syllabus and students are expected to carry out simple chemical calculations. These include the ability to use calculators, algebra and graphical skills; however, the mathematics required is quite basic. The use of graphs is limited to recording data and does not include using graphical techniques for topics such as kinetics. However the expectation for students to calculate pH and pOH from K_a and so on, is much more demanding.

The higher level syllabus includes two options which relate directly to core topics. These involve the application of topics, and one option, additional industrial chemistry, is a case study from the Irish chemical industry. Some other qualifications included in this study encourage teachers to provide their students with opportunities to learn from local or national industry, but this is the only syllabus including specific materials.

It is not clear from the syllabus whether student choice is in fact limited by their school's choice of courses. If fully available these options enable some choice of content to match individual student interests. The higher level syllabus, including all the options, covers over half of the topics included in the OCR A level syllabus. The practical programme is strongly emphasised in the syllabus which gives suggestions of both teacher demonstrations and student experimental work in support of all core topics.

The National Council for Curriculum and Assessment (NCCA) provides syllabus and teacher support materials via its website[20] and in print. These include materials and activities designed to assist teachers in developing their skills in teaching, learning and assessment strategies.

The NCCA and other government organisations do not endorse textbooks.

The syllabus has five assessment objectives: knowledge, understanding, skills, competence, and attitudes. Assessment broadly covers 70 per cent content and 30 per cent skills in how science works. The assessment materials are clearly structured and give details of what students need to do in each part of a question. However the marks allocated for parts of questions are not always clear. The question papers are closely written in a small font and students are provided with a separate answer booklet. Students have significant choice of questions, and even parts of questions. Therefore they need to read all the materials closely in order to select the appropriate number of questions including their optional topics.

Practical knowledge is assessed through questions within the external examination. Students are tested on the 28 mandatory practical procedures listed in the syllabus content. There is no assessment of practical skills.

The question paper tests students' knowledge and recall. The wide range of possible question combinations and the variable nature of the questions could have an impact on the assessment demand experienced by individual students. However there is so much choice of questions that students can avoid some topics completely. There is very little opportunity to demonstrate higher-order thinking skills.

Less than 15 per cent of the assessment relies upon mathematics, use of graphs, and so on.

The mark scheme clearly identifies the correct response and the particular skills assessed by each question. There is separate guidance for mathematics allowing marks to be deducted for poor arithmetic. Some questions also allow additional "free marks" to be allocated for high-performing students.

The Leaving Certificate Chemistry syllabus is currently being revised. The new syllabus, to be introduced in the next few years, is intended to include a practical assessment component.

[20] www.ncca.ie (accessed on 15th May 2012).

Republic of Korea – *Su-neung* (College Scholastic Ability Test, or CSAT)

The Korean College Scholastic Ability Test (CSAT) is designed to select students for study at South Korea's universities and other higher education institutions. Chemistry is one of the four subject options within the CSAT science assessment.

The syllabus aims to encourage the development of lifelong scientific study and emphasises student interest, motivation and enjoyment. The Chemistry 1 course drives the qualitative development and investigation of chemical principals through relevant contexts. The Chemistry 2 course is more specialised with higher expectations in the quality of quantitative investigation. The syllabus is clear that students will be tested on chemical concepts and their ability to both link and apply them.

The topics covered in Chemistry 1 include the basics of chemistry, inorganic chemistry and simple organic chemistry in context. The course emphasises chemical themes by introducing core topics through the three tangible topics of water, air and metals. Chemistry 2 covers physical chemistry in some detail, including thermodynamics, equilibria and kinetics, and inorganic chemistry in the context of redox reactions. It covers about two-thirds of the topics included in the OCR A level syllabus. The syllabus has little about organic chemistry but the content of the assessment suggests that this is taught in some detail.

Mathematics is taken as a compulsory examination within the CSAT. There is no complex mathematics within the course and the assessment only requires basic manipulation of algebraic expressions relating to density, volume, mass and moles; and interpretation of graphs.

Practical work and skills are embedded in the syllabus and teachers are provided with support in the form of a study instruction plan. The course specifies experiments to support the learning of particular topics. This includes investigative assignments with a strong emphasis on practical investigation and report-writing. Practical work is assessed in class with experimental reports and observation of student performance. However this does not contribute specifically towards the final CSAT mark.

Textbooks for use in Republic of Korea schools are approved by the Korea Institute for Curriculum and Evaluation (KICE). The Republic of Korea government has also announced plans that by 2015 all school textbooks and support materials will be available electronically.

The CSAT assessments test recall of basic concepts and also the linking of these concepts and the ability to apply them through multiple-choice problem-solving questions.

United States of America – the ACT

The ACT is designed to assess how well prepared upper secondary students are to study in higher education. Chemistry is a compulsory part of the test.

ACT designs the test based on test specifications that reflect the skills that students need to be successful in entry-level college courses. In order to provide the test ACT collects details from its National Curriculum Survey as well as from years of data and research examining college requirements. Chemistry is part of the ACT Science Test.

Mathematics is tested separately; therefore the mathematics requirements within the science test are kept at a minimum.

As a stand-alone examination, there is no scope for any practical assessment.

ACT provides large amounts of support documentation and publishes its research on its website[21]. This includes practice and sample tests, but not textbooks.

The ACT Science Test presents scientific information in one of three formats, “data representation”, ”research summaries” and ”conflicting viewpoints”, and provides seven passages for students to read. The questions are clear and demanding, requiring a high degree of analysis at both question and answer level (the distracters were very close to each other). Answering 40 questions in 35 minutes requires a high level of science literacy and comprehension; this test would stretch the most able students.

The ACT Science Test requires minimal skill in mathematics and is machine-marked.

United States of America – New York State Regents Diploma

The high school programme in New York State is designed to be studied by the full range of students, rather than only those planning to continue their studies at university. The Grade 9–12 courses are part of the wider New York State science curriculum and build upon the knowledge, understanding, and ability to do science that students have acquired in their earlier grades. The study of science is compulsory to achieve the Regents Diploma, however chemistry itself is not compulsory. Taking chemistry within the diploma uses about 5 per cent of the Regents Diploma course time; the chemistry course delivers one of the 22 credits students are expected to gain through their study within the high school programme. In England a typical student takes three A levels using about 30 per cent of course time per subject.

[21] www.act.org/aap (accessed on 15th May 2012).

The New York State core curriculum for chemistry provides broad, unifying, general statements of what students need to know. The supporting materials outline the need to develop essential knowledge and understanding of different areas of chemistry and how they relate to each other. This core curriculum covers standards 1, 2, 6, 7, and the process skills based on standard 4 in conjunction with standard 4. Detailed course content and timing are developed by individual schools to provide a "student-centered, problem-solving approach to Chemistry" (Regents Diploma assessment materials).

The approach to topics includes colligative properties, and little about modern analytical techniques, although chemical energetics are included. There is a section on nuclear chemistry which is well developed. The syllabus covers over half of the topics included in the OCR A level syllabus.

The syllabus does not provide a detailed overview of the mathematical content. However within the syllabus it is clear that an extensive knowledge of mathematics is not required. Some mathematics skills are required in responding to the paper.

Before a student can take the Regents examination they must have sufficient laboratory experience. The syllabus does not contain a practical programme.

The New York State Education Department (NYSED) provides support documentation and resources through its website[22]. It also provides programmes of training and development for teachers across New York State. The syllabus provided in the *Physical Setting / Chemistry Core Curriculum* document is an example of its detailed support for course content.

The Regents Diploma assessment objectives are clearly defined to cover the range of chemistry topics within the syllabus. The assessment materials are clearly presented with short, well-phrased questions, sometimes providing students with additional support.

The majority of questions require recall of knowledge or recall and a straightforward application of knowledge. Some are more demanding because they ask the student to apply their knowledge to an unusual context. The other questions involve reading a short piece of text and then making specific responses. The questions are very closely related to the syllabus content and do not seek to go beyond this. Higher-ability students would not be challenged by this paper.

Less than 10 per cent of the assessment relies upon the use of mathematics, use of graphs, and so on.

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[22] www.nysed.gov (accessed on 15th May 2012).

Marking support is provided for the Regents examination which gives the correct response for each of the multiple-choice questions. It also details the acceptable answers for each short-answer question and gives guidance on allocating the one or two credits (marks) per question. The marking process is tightly controlled by NYSED to ensure accuracy and fairness with at least two markers involved in marking each paper before the total score is recorded.

University of Cambridge International Examinations AS levels and A levels

The University of Cambridge International Examinations A level qualifications (or Cambridge International A levels) are designed primarily for students who intend to continue their studies at university. Chemistry is a subject choice. As with the A level in England, a typical student takes three A levels using about 30 per cent of their course time per subject.

The syllabus aims to give an introduction to the study of chemistry and includes integration of chemistry into daily life and an awareness of the impacts of chemistry. It addresses problem-solving skills for scientific investigation and communication; pattern recognition and practical skills.

The syllabus provides a significant level of details about topic content. There is a comprehensive range of materials which are functional, detailed and supportive. In addition to the majority of topics included in the OCR A level syllabus, this course includes a more in-depth study of biochemistry, and materials and their applications.

Details about the range of mathematical skills that are needed to support the study of chemistry are stated to enable students and their teachers to know what is expected of them.

The University of Cambridge International Examinations (CIE) website[23] provides support through information and resources. This includes access to full sets of previous assessment materials, example responses and teaching support materials. There are also professional development events for teachers. They also endorse textbooks.

The assessment objectives are clear and cover the full range of syllabus content. The examination paper is well formatted with students guided through questions.

About 15 per cent of the assessment relies upon the use of mathematics, use of graphs, and so on.

[23] www.cie.org.uk (accessed on 15th May 2012).

University of Cambridge International Examinations Pre-U Diploma

The Cambridge Pre-U Diploma (or Cambridge Pre-U) is designed for students who intend to continue their studies in science at university. Chemistry is a subject choice. Taking chemistry within the diploma uses about 25 per cent of the Pre-U course time, because a student studies global perspectives and research in addition to their three chosen subjects. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The syllabus aims to equip students with the skills required to make a success of their subsequent studies at university, involving not only a solid grounding in each specialist subject at an appropriate level, but also the ability to undertake independent and self-directed learning and to think laterally, critically and creatively. The syllabus content is presented in a way which clearly shows where the material will appear in the examination papers.

The Cambridge Pre-U includes a very similar range of topics to the Cambridge International A level but in more depth than any other qualification included in this study. This goes beyond the level of content usually required at this level. The syllabus includes alternative approaches to the teaching of organic chemistry and bonding, which are designed to deliver the subject of chemistry as a more cohesively organised discipline, rather than a large selection of ideas to be recalled. The assessment instrument reflects this philosophy in that it is not heavily weighted towards recall but involves higher-level skills, thus adding to the demand.

The course materials provide a clear overview of the mathematical content of the syllabus.

The syllabus emphasises the importance of practical work in reinforcing theoretical learning, encouraging understanding of the scientific method, and developing practical skills. Students are recommended to complete at least one practical investigation to follow through the experimental process and prepare for the significant practical element in the final assessments.

The University of Cambridge International Examinations (CIE) website (see footnote 23) provides support through information and resources. This includes access to full sets of previous assessment materials, example responses and teaching support materials. There are also professional development events for teachers. However, they do not publish or endorse textbooks.

The Cambridge Pre-U assessment objectives are very clear and detailed with over 20 per cent of the assessment relies upon the use of mathematics, use of graphs, and so on.

6 Findings: English

6.1 Summary

The qualifications considered within this study approach the academic study of English in a number of different ways. This is reflected in the content of the course syllabuses as well as the overall breadth of the student's study programme. Unlike the other subjects included in this study, English courses were only included where English is the main language of tuition. Within this smaller selection of qualifications there are still clear differences in basic design which relate to the target student populations and the national structure of senior secondary studies.

The borders of the subject area, contents and underlying philosophy are defined differently in different education systems. The flexibility in some courses reviewed, where students can make choices within papers, for example, could increase opportunities for higher achieving students to demonstrate their knowledge, skills and application. Likewise, within coursework options, student choice often requires independent thinking and decision-making. Within the courses which included some study of English literature the definition of text and notions of canonicity varied considerably. The set materials in some genres (poetry) and certain periods (Middle English) is particularly demanding.

In addition to the basic differences in design the qualifications in the English section of this study vary greatly in terms of their aims and rationales. Where possible the study includes the course which focuses on the study of literature and literary skills, for example the AQA A level, both Hong Kong qualifications (HKALE and HKDSE) and both University of Cambridge International Examinations (CIE) qualifications (A level and Pre-U). All of these are optional courses of study, and all except for the Pre-U also offer courses including English language. In Hong Kong, the HKALE AS Use of English and HKDSE English language courses are compulsory, although neither of these courses has been considered by this study.

The USA qualifications included in this study concentrate focus predominantly on language and broader communicative practices. While the rest combine the study of language and literature in different proportions. A number of qualifications place emphasis on preparing the students to operate effectively in the adult world rather than aiming specifically to prepare students for higher-level English studies. The Alberta Diploma course also sets out to encourage students to develop their Canadian identity by including Canadian authors in the reading list.

The USA ACT is the only qualification which does not follow a specific course of study. It has been included in this study as an assessment taken by senior secondary students and because the results are used in applications to universities and colleges. However, ACT is a stand-alone test which aims to assess "college readiness" of a student's English skills rather than directly testing the knowledge,

understanding, skills and application developed by a student over a particular course of study. Therefore it does not have a syllabus and is considered only as an assessment.

Within the courses which focus primarily on literature topics, there is a variety of conceptual frameworks in place. Some seem to be more closely aligned than others with contemporary critical theory. Some qualifications focus on their own national literature, on the literature of the UK and North America or encourage a more international perspective. All state a commitment to developing students' critical abilities and to encouraging an enjoyment of reading..

Despite the differences of approach there were some subject-related skills which were included in all course syllabuses: close reading (especially of unseen materials), independent thinking, reading and research, and sustained written or oral argument.

The International Baccalaureate Organisation has a unique approach developed to meet the needs of their multi-cultural and multi-lingual students. The IB Diploma Language A1 course is constructed to be studied by a student in the language with which they feel most familiar when reading, studying and writing about literature. The course can be used in the study of a chosen language supported by appropriate texts chosen from the IB literature lists and elsewhere. This study has only considered the study of Language A1 for English.

As with their aims and rationales, the structures of qualifications are equally varied. The majority offer a combination of written examinations and internal assessment, with a variety of weightings. Those which concentrate most on testing literature topics usually specify (though not always assess) the study of Shakespeare, though the prescription of period and genre is more variable. Particularly striking is the different definitions of a "text". While some qualifications concentrate more or less exclusively on written text, others take a much more multimedia approach, with film and visual texts appearing with some regularity.

Comment on the content of the internally assessed components and other components which allow free choice of text is limited as this is dependent upon the selections made by teachers and students.

Schemes of assessment also differ considerably: some are modular, some linear, some offer internal and external assessment, and some consist of just two (in New York State just one) terminal papers. The opportunity for retakes is governed to a large extent by the nature of the qualifications and their place in the whole curriculum. The ACT aptitude test, for example, can be taken up to 12 times as part of a student's preparation for entry to post-secondary education with ACT's own research showing that most students take the test twice with over half improving their

overall score (ACT, 2012c). In contrast the Republic of Ireland Leaving Certificate is clearly intended to be a final assessment prior to the student moving on to higher education or employment. Such differing schemes inevitably raise a number of issues, such as how well each caters for the recursive nature of the subject, as well as issues of comparability of outcomes.

A wide range of assessment methods are employed in the qualifications reviewed. Internal assessment includes conventional essay-writing, creative and re-creative[24] writing, and oral presentations; with word limits from between 600 to 3,500 words. External examinations include multiple-choice, short-answer questions, open-ended essay questions, and questions testing unseen materials. Some of the qualifications testing knowledge and understanding of literary texts allow students access to texts in some or all of the written examinations, while others have only closed-text examinations.

The timing of examinations varies widely, with the duration of examinations spanning from just 35 minutes (ACT Reading Test) to three hours 20 minutes (Republic of Ireland Leaving Certificate). Most examination papers are around two hours in duration.

Mark schemes vary from the brief and entirely generic, to the detailed and question-specific. The amount of indicative content provided is usually in line with the degree of prescription in the qualification (those qualifications which specify the testing of a range of set texts tend to provide the most). Indicative, rather than prescriptive, mark schemes were judged to be particularly useful for both students and teachers as part of the learning and teaching process. New York State in particular provides comprehensive marker support materials and follows a strict moderation process.

A table summarising the key features of the assessments for each education system included in the study and a summary of what each course covers appear in Table 4 and Table 8 of the Full Report Table Supplement.

Content, coverage and depth

As there is considerable overlap between the aims and rationales of the various qualifications, they have been taken as a whole for the purpose of this section.

It is clear that the qualifications included in this study have quite diverse aims. The AQA B A level, the Cambridge Pre-U, the Cambridge International A level and the International Baccalaureate Diploma concentrate on literature, the latter offering a

[24] Re-creative: literally “create anew”. A re-creative task is based upon source materials and requires the student to consider the content from an alternative viewpoint and produce a new text, often in a different genre to the original, which is supported by textual evidence from the original material.

more global perspective on the subject. Others, such as NSW HSC and New Zealand NCEA Level 3, and to a lesser extent Alberta Diploma, New York State Regents Diploma and the Republic of Ireland Leaving Certificate, make the boundaries of English and English literature more porous, placing emphasis on the study of English to enable students to become good communicators, readers, thinkers and citizens. These qualifications allow for the study of a wide range of text types (photographs, films, journalism, screenplays) not seen in the syllabuses that concentrate more exclusively on literature.

Some education systems, such as Alberta and the Republic of Ireland place emphasis on their national literatures; while in Hong Kong the focus is on European and North American materials. Both the ACT and the New York State Regents Diploma have pragmatic aims: the former to measure a student's readiness for post-secondary education, the latter to prepare the student for the world beyond school.

The English A level qualification included in this review features a notable emphasis on the process of reading and interpretation, especially compared with both the Cambridge Pre-U and the Cambridge International A level.

Most qualifications provide useful support material. The Alberta Diploma, the New York State Regents Diploma, New Zealand NCEA Level 3 and the Republic of Ireland Leaving Certificate all provide high quality materials, useful for both students and teachers (and, in the case of Canada, parents). Canada, New York State Regents Diploma and New Zealand produce particularly helpful exemplars of students' work.

The comparison of assessment objectives in courses which focus on both language and literature (often both reading and production) with those in an English literature course (AQA B A level) means that judgements are often rather difficult to make. Those courses that are viewed as most appropriate as preparation for future study in the UK tend to have very similar literature-related objectives to the A level. While the International Baccalaureate Diploma is very close in demand, it could be suggested that its requirement for intercultural awareness may make it more demanding. Conversely, whilst the International Baccalaureate Diploma's requirement for close analysis of unseen texts increases demand, this is offset by its being less rigorous in assessing understanding of context and its effects than AQA B A level.

The New York State syllabus offers no set topics, being driven instead by the testing of language skills, with the "Critical lens" section offering students the chance to undertake a sustained writing exercise on a free choice of literary texts. This could be a challenging task, depending on the text chosen.

The Alberta Diploma's emphasis on a personal, experiential response is very different to the approaches seen and may lead away from higher-order skills of close

literary analysis; moreover, the course requires the testing of far fewer texts than some others in this review, such as AQA B A level.

The New Zealand NCEA Level 3 allows for a good deal of choice in terms of which achievement standards are taken, meaning that there is no fixed profile of an English student. One might have taken all seven Standards and have covered an extremely wide range of topics and tasks, including "typical" A level texts; others might have concentrated on language-based topics (including oral presentations).

In the case of the Republic of Ireland Leaving Certificate syllabus, the lack of internal assessment throws the emphasis on the written examination, with a narrower range of texts and topics and no requirement to engage with literary theory.

The nature of the topics of the HKALE is more challenging than those in the HKDSE, with the HKDSE's narrower range of texts reflecting the significant changes to qualification design within Hong Kong. The wider range of study within HKDSE means that Literature in English takes about one third of the study time previously allocated to the HKALE course. The portfolio requirement for both HKALE and HKDSE offers plenty of student choice and the opportunity to explore a range of writing styles, including film study. Students taking either of the Hong Kong Literature in English courses are supported by the compulsory English courses within those qualifications. Each of these compulsory courses takes up about a further 15 per cent of the student's HKALE or HKDSE course time.

The NSW HSC course features an inter-textual approach. The interdisciplinary nature of the course (mixing traditional literary topics with media-based topics, for example), the emphasis on oral competency, and the opportunities offered for imaginative writing are distinct from other courses.

The International Baccalaureate Diploma emerges as the most comparable with the AQA A level in the range of topics offered and the combination of breadth and depth of study. Both A level and the International Baccalaureate Diploma manage a good balance between core and optional elements, encouraging students' independent thinking and research skills. The Cambridge International A level and the Cambridge Pre-U are very close to A level in terms of content and structure, with both offering the same balance of core to optional topics.

Taking all factors into account, AQA A level and the International Baccalaureate Diploma stood out as maintaining a good balance between core and optional elements, whilst encouraging students' independent thinking and research skills.

Assessment

The most demanding types of examination questions are extended, unstructured questions requiring substantial argument. While short-answer and stepped questions

are useful in varying the pace of an examination and catering for the lower-achieving students, they may also hamper the more able, especially when used to test unseen material. Successful questions are those which employ straightforward language, contain a manageable number of factors for consideration and employ a variety of command terms.

Some of the qualifications included in this study rely on an extensive use of multiple-choice questioning in their examinations, making it impossible for students to undertake critical responses to texts (apart from those offered in the answer options). The number of texts assessed in examination conditions is also variable, generally restricting the range of demand within the assessment..

The support of mark schemes where assessment objectives are clearly mapped to questions, and provide indicative content which is illustrative, rather than prescriptive, are more appropriate for students looking to progress to higher education in the UK as they could be used by both students and teachers as part of the learning and teaching process.

Different approaches were taken to coursework. For example, in the Cambridge Pre-U Personal investigation, one sustained piece of writing produced without teacher support is very demanding. The A level, AQA B, requires for four pieces of coursework, but does allow limited teacher support.. Both methods enable the students to demonstrate higher order skills.

The ACT and New York State Regents Diploma (post-2011) require little literary analysis and the Alberta Diploma seeks answers based on personal response rather than on the close analytical skills.

The quality of questions will affect the demand of assessments for students. Most courses have clearly expressed and straightforward phrasing, comparable to the AQA A level. Those which were generally seen as being more difficult were the CIE Pre-U, HKALE and HKDSE Questions on the Cambridge Pre-U papers use less straightforward language and include more factors for consideration. The Hong Kong questions are often very long, with many separate factors to address. The mark schemes provided all supported the marker in identifying student achievement, and those which provided clear guidance would also be useful to teachers and students. Annotated samples of marked scripts supplied for some assessments (New York State Regents Diploma, Alberta Diploma, HKDSE, New Zealand NCEA Level 3) provided useful information for forming judgements, as did examiners' reports.

6.2 English findings by education system

Australia – New South Wales Higher School Certificate, or HSC

The Higher School Certificate (HSC) in New South Wales (NSW) is designed to be studied by the full range of students, rather than only those planning to continue to university. English is the only mandatory subject in the HSC, students need to take one preliminary course and one HSC course in English (Standard); English (Advanced) or English as a second language. Taking any of these pairs of courses takes about 20 per cent of a student's overall HSC course time.

Students taking the English Advanced course can add the extension 1 course, which promotes independent learning and engagement and provide students with opportunities to prepare for further study of English. Taking the Extension 1 course takes a further 10 per cent of the students overall HSC course time. However this study focuses on the English Advanced course.

The syllabus states the guiding principle of all the English courses is that students should work towards becoming "confident, articulate communicators, critical and imaginative thinkers, and active participants in society" (Higher School Certificate assessment materials). Students are exposed to English in a wide variety of forms and encouraged to recognise how the use of language changes to meet the needs of different audiences and situations. This is designed to develop both their critical skills in analysing text, an understanding of their own responses to text and how this in turn supports their own compositions.

The content and structure of the course provide a wide and exciting experience of English. The texts studied come from a wide range of periods and genres, and are expected to include classics, successful teaching texts and innovative recent works. There is no use of particular genres or time periods as organising structures, but Shakespearian drama is compulsory. The focus on particular areas of study, such as "Belonging", is a useful way of signalling connections between texts and for creating a holistic paradigm for the study of English. The diverse range of text types on offer also allows for a unified study of literature and language.

There are no optional elements within the HSC course, but teachers and students do have the opportunity to select the materials used in addition to the prescribed texts. There are also choices of materials and subject matter within the modular section of the course which concerns the representation of information, textual integrity and value.

The HSC features an inter-textual approach. The interdisciplinary nature of the course (mixing traditional literary topics with media-based topics, for example), the emphasis on oral competency, and the opportunities offered for imaginative writing are distinct from other courses included in this study.

The scheme of assessment provides for a balanced weighting between internal and external assessment and uniquely includes imaginative writing. The two papers are well designed and holistic and utilise the widest range of assessment methods.

Paper 1 is common to Standard and Advanced levels testing students' ability to analyse familiar and unseen texts and compose responses with both short and extended response questions Paper 2 tests the skills developed in the modular section of the course through sustained response and includes some demanding questions which invite high-order thinking. The high proportion of questions requiring comparison and the time allowed for the assessment work together to further increase the level of demand.

Mark schemes are made up of generic guidance comments, with descriptors provided for five mark bands.

Overall the HSC syllabus is the broadest of any qualification included in this study, both in the range of materials studied and the skills which students have the opportunities to practice and develop.

Canada – Alberta Diploma

The Alberta Diploma is designed to be studied by the full range of students, rather than only those planning to continue to university. English Language Arts (ELA) is a compulsory part of the Diploma. Students must pass ELA 10-1 and 20-1 courses in order to take ELA 30-1. These three courses take up about 15 per cent of the student's overall Diploma course time.

The stated aims of the ELA courses are that students should study literature as a means of gaining understanding of themselves, of the world around them, and of "the characters that literature creates" (Alberta Diploma assessment materials).. Students are encouraged to appreciate the significance and artistry of literature, as well as developing their own confidence and competence in writing for a wide range of audiences and purposes. The course aims to develop strong language users, prepared to meet the challenges of the workplace or post-secondary studies.

In terms of content and structure, the minimum requirement for text study is broad and a third of texts must be the work of a Canadian author. The requirement for students to study Canadian texts is intended to encourage them to reflect on their own ideas and experiences of citizenship and to develop respect for cultural diversity and common values.

In the Diploma examination Part A requires two sustained responses (one to unseen texts and one to a text chosen by the student) on a particular theme (for example: "ways in which individuals take responsibility for themselves"), both urging students to draw on their own experiences and feelings. The common theme for both pieces of

writing may reduce demand but the tasks are quite open-ended, with ample scaffolding in the form of planning space and prompt questions. The personal response required is different in this assessment with students asked to draw on their personal life experiences. Other assessments expect students to offer a personal response through their own analysis and ideas about texts.

Each part of the assessment has guidance for markers with five band descriptors for Part A progressing from “Excellent” through to “Poor”, with “Insufficient” being used for rubric infringements and absence of writing. Marking guidance is helpful and clear, supported by samples of marked examination scripts.

Part B consists of 70 multiple-choice questions on a wide range of short texts, including some excerpts from extended texts. These include modern drama (theatre, television, radio or screenplays), poetry and song, non-fiction and response to non-fiction. The extracts are quite challenging although the opportunities for students to develop their response to the texts is limited by the use of multiple-choice questions..

Overall the Diploma ELA syllabus is one of the narrowest of any qualification included in this study, both in the range of materials studied and the skills which students have the opportunities to practice and develop. The focus is upon personal response and anecdotal writing, rather than the content and skills found in other qualifications in this study.

England – A levels

The A level is designed to be studied by students who have been successful in level 2 English studies and wish to continue with the subject, although not necessarily to study English at university. After completing half the course, students may claim a qualification called the AS level, with the second half of the course being called A2. Together they make up the A level. A levels are offered by five different organisations in England, and they contain some variation although they are based on a common set of criteria set by Ofqual. A typical student takes three A levels using about 30 per cent of their course time per subject

This study considered the A level English literature specification B offered by AQA. In addition to English literature, qualifications in English language and in English language and literature, are also offered by most of the awarding organisations offering A level qualifications in England.

The syllabus explains that “the exploration of reading processes can be an interesting and enriching way to approaching literary texts” (A level assessment materials). Within the AS (first year) course focuses is on storytelling and the construction of alternative realities. The A2 (second year) course extends this to include different critical approaches and the interpretation of cultural meanings. It

encourages students to develop their interest in and enjoyment of literature and literary studies through reading widely and independently.

There are four nationally prescribed assessment objectives which are common to all English Literature A level specifications regardless of the organisation offering the qualification.

In terms of content and structure, students study a minimum of 12 texts. The external assessments focus on these prescribed texts, while the internal assessments allow for a freer choice of text by both student and teacher. Study may include a text in translation.

The syllabus is well structured, with clear connections across and within units. There is a good range of topics, ensuring a comprehensive study of genres, and this genre-led approach is used to support a broader understanding of literary concepts than may be possible in a syllabus based on isolated texts or even literary periods. In particular, the mandatory study of an anthology of critical writing stretches the more able student.

Independent reading and research is encouraged and there is an opportunity to undertake recreative writing as part of the student's coursework portfolio.

The specification includes a number of prescribed texts that can be taught as part of the course. While some texts are more challenging than others in the list, this does not appear to affect the demand of the qualification overall.

The questions set on both examination units are clear, economically worded, and accessible to all students in the ability range. There is a sound match of assessment objectives to questions.

Mark schemes are made up of a list of basic principles for markers, a grid with generic descriptors for each assessment objective assessed within each of six bands, and brief indicative content.

Hong Kong Advanced Level Examination, or HKALE

The HKALE is designed to be studied by students who have been successful in the Hong Kong Certificate of Education Examinations and wish to continue their studies, although not necessarily to study English, at university. All students take the AS Use of English qualification, but this study considers only the optional HKALE Literature in English qualification as a closer comparison with the AQA English Literature A level. A typical student taking Literature in English A level alongside 4 other subjects at AS uses about 30 per cent of their study time for the A level

At qualification level, the examination aims to assess how well students have understood and appreciated representative literary texts (including films) as well as

related cultural forms in order to develop a greater awareness of the relationship between literature and society.

The syllabus' stated aim is to offer "representative literary texts"; however the prescribed range is narrow in comparison to other the other English literature qualifications considered by this study. In particular the selection for Paper 1 lacks in breadth; however, the texts chosen are well grouped and the inclusion of film texts is in line with the course aim to encourage students to make connections between texts and the contemporary world. Addressing the topics for Paper 2 require a broader cultural understanding of period and contemporary issues.

Although English is the language of tuition in Hong Kong the prescribed texts and films are essentially European and North American, set within western hemisphere cultural contexts. Students are therefore studying a foreign literary tradition and this may explain why knowledge appears compartmentalised and the course structure unlikely to provide a clear sense of historical perspective or connections between texts.

However, the portfolio work produced for internal assessment provides excellent opportunities for students to engage with the course content, allowing them opportunities to experiment with their own writing and responses to texts; it also caters well for all levels of the ability range.

The examiner's report, which specifies the typical content of students' answers, is useful, as it demonstrates how the assessment objectives link to questions. Without the report it is difficult to see how questions match assessment objectives and the intention of some questions is unclear. There are some questions, especially those of a semi-creative nature, which encourage students to make assumptions that may not be based on literary principles and to treat texts as if they were transparent representations of reality. This is a different approach to that taken in the other English literature qualifications considered in this study.

The mark scheme provides seven mark bands with very brief descriptors for each.

The study found that the HKALE Literature in English course had narrower content than the AQA English Literature A level. However, this finding does not take into account the additional English studies undertaken by students in the compulsory HKALE AS Use of English qualification.

Hong Kong Diploma of Secondary Education, or HKDSE

The HKDSE is designed to be studied by the full range of students, rather than only those planning to continue to university. English language is a compulsory course in the HKDSE, but this study considers only the HKDSE Literature in English course as

a closer comparison with the AQA English Literature A level. Literature in English is an optional course taking up about 10 per cent of a student's HKDSE course time..

The Literature in English syllabus provides students with opportunities to develop their knowledge and literary skills of comprehension and appreciation. Teachers are also encouraged to coordinate student's studies of this course with the English language course in order to maximise the opportunities students have to learn about English as a whole subject.

HKDSE is a new course of study first taught in 2009 with the first examinations due to take place from April 2012. Consideration of the assessment materials has therefore been limited to the sample materials provided for teachers at an early stage to assist their preparations for teaching the course.

Although English is the language of tuition in Hong Kong the sample sets of prescribed texts and films are essentially European and North American, set within western hemisphere cultural contexts. Students are therefore studying a foreign literary tradition and this may explain why there is a narrow range of topics and set texts.

The stated assessment objectives are not clearly reflected in the questions seen. That is, students are expected to demonstrate a number of high-level literary skills and an understanding of literary concepts, but questions do not always test these in any clear or systematic way.

The assessment is driven by the study of single texts, with no apparent over-arching principle or concept. Questions are straightforward, though not always successful at prompting a literary response. The stepped, directed questions on the Appreciation paper would not encourage a personal response from students and the timing of the paper is tight. However the assessment is accessible to students across the ability range.

The portfolio work provides an opportunity to broaden and enrich the scope of the study through developing more awareness of and understanding of generic forms. This is generally undertaken in the third year of the course allowing students to utilise earlier learning across both English courses.

The Level descriptors are clearly intended to discriminate across the full range of student ability.

The study found that the HKDSE Literature in English course had narrower content than the AQA English Literature A level. However, this does not take into account the additional English studies undertaken by students in the compulsory HKDSE English language course.

International Baccalaureate Diploma

The International Baccalaureate (IB) Diploma programme is designed to prepare students to continue their academic studies at university. The study of a first language (Group 1 – Language A1[25]) is a compulsory part of the Diploma. Study of the chosen Language A1 takes up about 20 per cent of the IB Diploma course time.

The syllabus provides opportunities for students to learn about their chosen language, the literature which uses it and how to use it expressively. This includes developing recognised literary skills of appreciation and criticism. The syllabus offers a very good range of texts across all components and it successfully combines close analysis and breadth of study. The overall structure allows teachers considerable freedom to construct a course tailored to the particular needs and interests of students. This could raise issues over comparability of demand. The world literature topic significantly extends the students' reading and range of cultural reference and gives a strong global perspective to the syllabus. IB is the only course to specifically include translated texts.

The assessment objectives are clear and well matched to the assessment.

Both of the external examination papers are of a similar demand to the AQA A level. However, the absence of any single-text question does restrict opportunities for students to demonstrate their close reading and analytical skills. The coursework component is well-suited to the full ability range, offering a good deal of choice for the student across the full range of the language A1 syllabus. The oral tasks equate well with the written coursework tasks.

Mark schemes provide clear and helpful guidance; however the language used in the performance descriptors is sometimes imprecise (for example, "adequate understanding").

The Language A1 syllabus has potential for students to study the widest range of texts of any qualification included in this study.

[25] "Language A1" denotes the language with which students feel most familiar when reading, studying and writing about literature; this is most likely to be, but does not have to be, the language of instruction.

New Zealand – National Certificate of Educational Achievement, or NCEA Level 3

The National Certificate of Educational Achievement (NCEA) is designed to be accessible to the full range of students rather than only those planning to continue their studies at university. English is an optional subject taking up about 20 per cent of the NCEA course time, for a typical student studying five subjects.

The stated principles of the NCEA are that the student is at the centre; the syllabus underpins assessment and assessment capability is crucial to improvement.

The syllabus offers a very good range of topics which are interesting and engaging for students; they are well balanced, with plenty of sub-topics available in the externally assessed standards. The study of English is opened up by the lack of division between language and literature together with the inclusion of the literary text and other forms of written and visual production. The oral component is an educationally beneficial part of the programme on offer. Student and centre choices inevitably mean that there will be many and varied configurations of English under this model, and that certain elements of study can be avoided. There are seven achievement standards: four are externally assessed and three are internally assessed. Students need to gain at least 14 out of the 24 available credits for university entrance and students can choose predominantly internally assessed or predominantly externally assessed standards. All of the externally assessed achievement standards are tested in one examination session although students do not have to attempt all of the standards. Students are expected to achieve their credits from both internally and externally assessed standards.

Both types of standard offer students ample opportunities to study a range of text types and to respond to them in a variety of forms (written, oral, research). There are opportunities for overlap between the internally and externally assessed units; for example, the oral presentation could be focused on an externally examined text.

The internally assessed units are designed to test skills which are difficult to assess in timed conditions, while the externally assessed achievement standards are all text-based.

The questions are clear, open-ended and designed to elicit critical responses; there is a good degree of equivalence between the questions both within and across sections.

Overall, the externally examined achievement standards are more challenging than those which are internally assessed, and the time and word allowances may restrict the opportunities for more able students to demonstrate their full range of ability.

NCEA Level 3 English is assessed against the requirements of the registered achievement standards for English. With the exception of the mark scheme for AS90723, which gives some indicative content, mark schemes are generic and provide evidence statements for the three possible judgements: Achievement, Achievement with Merit and Achievement with Excellence. There is also a bullet-point list defining the characteristics of work which should be graded as Not achieved. The mark schemes are clear and easy to follow, if a little lacking in detail.

Overall the NCEA Level 3 syllabus includes a broad range of materials to study and skills which students have the opportunities to practice and develop.

The ministry has introduced a new curriculum for schools in 2010, which has resulted in a re-alignment of the NCEA achievement standards across all three levels. These will be implemented fully in 2013 with new standards at NCEA Level 3. The analysis and findings in this study are based on the outgoing standards which will be examined for the last time in 2012.

Republic of Ireland – Leaving Certificate (Established)

The Established Leaving Certificate is designed to be studied by the full range of students in the senior cycle (upper secondary), rather than only those planning to continue their studies at university English is an optional subject. Taking up about 20 per cent of the Leaving Certificate course time, for a typical student studying five subjects.

The syllabus requires the study of language in a wide variety of contexts, genres functions and styles and covers a broad range of topics, which appears comparable to the English language and literature A level course available in England. Structurally the course is organised around two general domains, comprehending and composing. Literature topics are dominated by 20th-century texts, however, the strong emphasis placed on poetry and on the inclusion of film as a text for study and analysis increases the scope and demand of the syllabus.

This qualification is assessed entirely through terminal written examinations:

The literature questions on Paper 2 are more demanding than those on English language on Paper 1, particularly the comparative question. However, the single-text questions are sometimes rather limiting, with a tendency to encourage the students to think in binary terms. The duration and content of Paper 2 are very demanding for students.

The absence of coursework hampers students' opportunities for independent research, though it is acknowledged that there are plenty of recommended wider reading texts which might lead to students pursuing their own interests.

The criteria for assessment are competence-based each criterion is weighted for each task and these weightings are converted to marks available for individual questions in the mark schemes. There is separate guidance for each task, with brief indicative content provided.

Overall the Leaving certificate syllabus includes a range of materials to study and skills which students have some opportunity to practice and develop. However this range is narrower than the content and skills found in other qualifications in the study.

United States of America – the ACT

The ACT is designed to assess how well prepared upper secondary students are to study in higher education. The English and reading tests are compulsory parts of the ACT and there is an optional writing test.

There is no specific test syllabus, but the test is designed by ACT to reflect the content of state course materials. In order to provide the test ACT collect details of all the state courses and also conduct research into college requirements.

ACT provides large amounts of support documentation and publishes its research on its website[26]. This includes practice and sample tests, but not textbooks.

Assessment objectives are precisely stated and questions are constructed to match them closely. Questions are of varying demand, and include accessible questions for lower-attaining students.

The ACT English Test uses multiple-choice questions to test student's understanding of the conventions of writing and rhetorical skills as demonstrated by texts. Similarly the ACT Reading Test uses multiple-choice questions to test students understanding of prose passages. The texts are selected to represent materials commonly encountered in the first-year of higher education.

Higher-attaining students are hampered by the rigid constraints of the multiple-choice format, and are prevented from demonstrating any flair, originality, opinion or nuanced understanding of writers' methods. However reading the unseen texts and successfully answering the volume of questions within the time allowed requires a high level of specific literacy and comprehension skills.

The writing test provides stimulus material which describes an issue and two possible points of view. Students are asked to write about their position on the issue and may adopt either stated positions or a different viewpoint

[26] www.act.org (accessed on 15th May 2012).

These are demanding assessments of a specific set of English language skills. All three tests are entirely skills-based and are intended to test aptitude and readiness for college entry. They do not cover some areas considered to be important, for example, researching and debating ideas; developing personal responses to texts; using language for a variety of purposes and audiences; understanding of the contexts in which texts are produced and read.

United States of America – New York State Regents Diploma

The Regents Diploma in New York State is designed to be studied by the full range of students, rather than only those planning to continue their studies at university. English Language Arts (ELA) is a compulsory part of the Regents Diploma. The full ELA courses deliver four of the 22 credits students are expected to gain through their study within the high school programme, using about 20 per cent of the Regents Diploma course time.

The ELA Core Curriculum highlights learning standards which are used to measure a student's success. A learning standard is an established level or degree of quantity, value, or quality. New York State learning standards are defined as the knowledge, skills, and understandings that individuals can, and do, habitually demonstrate over time as a consequence of instruction and experience. New York State has now adopted the Common Core Standards.

The learning standards provide the basis for schools to develop their ELA courses. Topics and sub-topics are taught and assessed through a variety of activities and tasks devised by the teacher throughout the school grades. In addition students take the external Regents Examination. This assessment is part of a broad educational process, with the examination operating as a culmination of the informal assessments which are ongoing throughout the student's school career. Topics are based on skills and the knowledge required to operate in the four language modes (listening, speaking, reading and writing). This holistic view of English as a subject sets it apart from the A level; however, the range of topics is limited and offers little breadth or depth. The assessment objectives are well matched to the questions. From January 2011, the ELA external assessment was restructured into one Comprehensive English examination paper. The paper uses multiple-choice questions to test listening and reading skills directly, with short and extended written tasks to test comprehension and writing skills. Opportunity for sustained and focused writing may be limited in this model.

The most demanding question is the critical lens, the final section of the paper. Although the open nature of the task and the students' free choice of texts might lead to prepared answers. The papers are clearly presented with helpful scaffolding for lower-attaining students and the choice of unseen texts relates very well to the contemporary world and would be of interest to students.

Mark schemes are clear and useful, with helpful samples of marked scripts being provided.

Overall the Regents Diploma syllabus is one of the narrowest of any qualification included in this study, both in the range of materials studied and the skills which students have the opportunities to practice and develop. The focus is upon the practical use of English, rather than the content and skills found in other qualifications in the study.

University of Cambridge International Examinations AS levels and A levels

The Cambridge International A level qualifications are designed primarily for students who intend to continue their studies at university. Literature in English is a subject choice. For a typical student taking three subjects Literature in English takes up about 30 per cent of their A level course time.

The syllabus aims to encourage students to read a wide range of texts across time and culture. Students have the opportunity to develop their response to literature and the associated skills of reading, analysis and communication in support of their own personal development.

There is a text-centric approach which focuses students on learning to read, understand, analyse and respond to texts as coherent entities. This approach differs from other Literature qualifications included in this study which are structured around genre study or theoretical approaches to the text.

The three core papers (3, 4 and 5) and the optional paper 6 are structurally identical, with students having the option to write a whole-text essay or one based on an extract from the set text.

The questions are clear and appropriately challenging, with plenty of focus on authorial method. The option of an extract-based question on all four papers encourages close reading and offers structure for the lower-attaining students.

Rubrics and presentation are clear, with plenty of space for the annotation of extracts.

The match of assessment objectives to questions is good and the mark schemes are generally straightforward, clear and accessible.

This study found that this qualification has very similar syllabus content to the AQA English Literature A level.

University of Cambridge International Examinations Pre-U Diploma

The Cambridge Pre-U is designed for students who intend to continue their studies university. Literature in English is a subject choice within the Cambridge Pre-U. For a typical student taking three principal subjects Literature in English would take up about 30 per cent of their Pre U course time.

Assessment covers at least six texts, covering poetry, prose and drama. They must include Shakespeare, and writing before and after 1900.

The Cambridge Pre-U has a linear syllabus, with all units being taken at the end of the two-year course.

The choice of texts has a predominance of the English canon. There is little contemporary writing with only three living authors, J. M. Coetzee, Derek Walcott, and Brian Friel prescribed. However this can be balanced by the personal investigation, with its free choice of texts, or through the preparatory reading and study for the unseen Comment and Analysis paper.

The assessment is single-text driven, with little attempt to encourage students to think about literature more broadly.

However, the topics are challenging and particularly suitable for high-achieving students, without excluding those of lower ability. The study of poetry and the testing of close analysis of unseen materials are particularly stretching, as are the recommendations for critical reading offered to students preparing for the personal investigation.

All papers have extended, unstructured questions requiring sustained writing.

The language framing in some questions is quite high level and not always commensurate with the question's actual demand (several of them relying on the relatively straightforward discussion of theme and character). Similarly, questions are complex in construction, sometimes requiring students to consider four or five separate factors. The Comment and Analysis paper provides stretch and challenge and is an effective way of encouraging wider reading by way of preparation.

The mark scheme is organised with reference to the assessment objectives and supported by the question-specific notes which provide the parameters within which markers may expect the discussion to roam. This guidance is clear and helpful.

This study found that the Pre-U has very similar syllabus content to the AQA English Literature A level.

7 Findings: History

7.1 Summary

The history courses included in this review have very different purposes and this affects any comparisons between them. For example, the course for the New York State Regents Diploma are clearly intended to build upon a regionally prescribed history or social studies course, which students have followed through their secondary education up to their respective starting points. Additionally, length of recommended teaching time and the sheer volume of content suggest how much history has to be covered by students. However other differences by themselves do not indicate different levels of demand.

For example, while a course that requires students to memorise more historical content might appear less demanding than one that requires complex understanding of historical concepts as part of an examination, this does not necessarily mean the entire qualification is less or more demanding.

Reviewers noted the following features which lead to courses being of a high demand:

- conceptual understanding
- the accurate and effective deployment of knowledge (which may be broad or in depth as they can be equally demanding)
- document-based skills – analysis and evaluations of sources and their integration with the student's own knowledge
- essay-based skills – discussion of issues, analysis and evaluation to reach valid, considered and supported judgements (these may be demonstrated in an oral examination)
- historical enquiry – the ability to ask relevant and significant questions about the past and research them.

The qualifications adopt a range of assessment methodologies. Some rely solely (or heavily) upon external assessment whilst others give considerable weighting to internal assessment. This is inevitably linked to the extent to which schools are able to devise their own teaching programme. This is also true in the case of those qualifications which include a personal investigation.

Oral examinations are a feature particularly of the STX in Denmark and *Vitnemål* in Norway. In the case of the STX the entire assessment is through an oral examination. For the *Vitnemål a*n oral examination is used, for some students only, as part of the validation of teacher / centre assessment. Additionally in the case of

the *baccalauréat général* in France an oral examination is used as an additional opportunity for borderline fail students to achieve a pass standard.

A few qualifications use multiple-choice questions, notably the *Gāokǎo* in the People's Republic of China, New York State Regents Diploma and the CSAT in the Republic of Korea. For the CSAT these constitute the entirety of the final assessment and for the *Gāokǎo* they constitute 50 per cent of the final assessment. This type of assessment tests a student's ability to recall the large amount of information they have acquired as part of the course, and is an effective way to ensure testing of a large part of a curriculum in a short period of time.

However, most courses reviewed rely on written assessment or examinations, and the essay question is the most consistently used question style followed by the source-based question.

The qualifications reviewed also differ in organisation. While the majority of these qualifications are free-standing, others combine the study of history with the study of another subject, such as the *baccalauréat général* in France and the *Vitnemål* in Norway, which combine history with geography and philosophy respectively. Finally, the qualifications place differing degrees of emphasis on: preparing students for higher study at university, developing students' critical thinking skills, developing citizenship and developing students' interest in history.

The respective qualifications describe their structure in similar ways. The historical knowledge or content is divided into topics, units or periods, and in some there are also themes running through. In terms of the historical content the differences in the nature and purpose of qualifications are clearly a factor in determining the extent to which students are required to study their own national history at one end of the spectrum and are expected to develop a wider continental or world view at the other. Related to this is the extent to which the qualifications offer choice to teachers on what content to teach. In some, such as the *baccalauréat général* in France or the New York State Regents Diploma, there is no choice, but in others, most notably the A level, there is very wide choice. It should be reiterated, though, that this choice is for teachers, not for students. The only way some of the qualifications offer students choice is on their examination papers. In terms of content, only where students are permitted to choose an extended personal historical investigation component are they able to make any choices regarding the content they study. Across all qualifications there is also a clear concern to balance the depth and breadth of historical study.

Linked to this is the way in which some qualifications view history as extending to the present day whilst other set a fixed end point in the recent past. Some qualifications such as the *Vitnemål* in Norway and the *Gāokǎo* in the People's Republic of China expect students to gain an overview of history stretching back to classical or earlier

times. Others focus upon the modern period, such as the *baccalauréat général* in France where the final class looks at history post-1945. In most qualifications history is seen as provisional; most explicitly stated by Edexcel's A level, but implicit in all those that describe history as open to interpretation. The New South Wales HSC course describes history as a "contested dialogue between past and present" (HSC assessment materials). Perhaps only in the *Gāokǎo*, the New York State Regents Diploma and the Republic of Korea CSAT qualifications does there appear to be an element of the view that history is uncontested with a definitive narrative version.

In all the qualifications historical understanding is not separated from historical knowledge. However the way in which historical concepts and processes are described or assessed does differ. Many qualifications express these as assessment objectives and the link between the two is explicit both in the outline of the course and on the examination papers. Other qualifications, for example the New South Wales HSC, describe course outcomes which include both historical content and skills, whereas others describe achievement standards (New Zealand NCEA Level 3) or learning outcomes (New York State Regents Diploma). Nevertheless the key concepts of time, change, causation and the processes of evidence and communication, structuring and supporting an argument with evidence are common to all. Two significant differences are the way in which some qualifications describe and assess historical interpretation, and the fact that some limit the extent to which students' understanding of historical enquiry can be assessed, by the absence of a requirement for an extended personal historical investigation.

The comparison of the individual qualifications revealed a number of similarities and some significant differences in terms of how assessment is managed. Amongst these is the number of assessment points, including whether a qualification is linear or modular. Then there is the balance between internal and external assessments, the degree to which the structure of internal assessments is prescribed and the extent to which assessments are externally moderated or not. With external assessment there are differences in their structure, their duration and the extent to which students can or cannot retake assessments. Finally, there are some qualifications where there is a clear progression in demand between the final assessments taken in the first and second years of a qualification, and others where this is not the case.

The mark schemes that accompany assessments vary in the level of detail and guidance that they supply for their first audience, examiners and for their second audience, teachers and students. They also reveal the extent to which examination questions actually match and assess the declared assessment objectives or learning outcomes of the qualification.

There is no comparable subject of study within the Alberta system, so it was not included in this study. Similarly, the ACT is not included as history is not a component of the test.

A table summarising the key features of the assessments for each education system included in the study and a summary of what each course contains appear in Table 6 and Table 10 of the Full Report Table Supplement.

Content, coverage and depth

All of the courses considered as part of this review view the study of history as a discipline as an important part of their rationale, but to varying degrees. The strongest statements are to be found perhaps in the Cambridge Pre-U and A level, the IB Diploma and the Edexcel A level. The only exceptions to this are the New York State Regents Diploma and the Republic of Korea CSAT where history is clearly placed within the context of a prescribed social studies programme. In two instances, the *baccalauréat général* in France and the *Vitnemål* in Norway, the discipline of history is seen as integrated with another discipline, geography and philosophy respectively. This last might also be claimed for the *Gāokǎo* in the People's Republic of China which has a strong political theory dimension.

For some of these courses the study of history is explicitly a preparation for study at a higher level / university, namely the People's Republic of China *Gāokǎo*, the Edexcel A level, the *baccalauréat général* in France, the Finland Matriculation Examination, the IB Diploma, the Netherlands havo and vwo and the Cambridge Pre-U. For others the skills and understanding derived from studying history are seen as a preparation for life and citizenship, for example the Denmark STX, the Hong Kong HKALE and HKDSE, the Republic of Ireland Leaving Certificate, the New South Wales HSC and the New York State Regents Diploma. Additionally, some place an emphasis on students learning about the culture of their country, such as the Matriculation Examination in Finland, the *baccalauréat général* in France and the havo and vwo in the Netherlands.

Some of these form part of a curriculum where the study of history is prescribed up to the end of compulsory secondary education, such as in the *baccalauréat général*, the New South Wales HSC and the New York State Regents Diploma. Both of these factors clearly influence the extent to which the courses require students to study their own national history.

Of the countries which do require students to study their own national history the weightings vary. In the Edexcel A level, students spend a minimum of 25 per cent on their national history as do Matriculation Examination students in Finland. The New York State Regents Diploma is entirely on US history whilst that for the *Gāokǎo* places Chinese history firmly at the centre of its content. Of the rest, the Republic of Ireland Leaving Certificate course requires 50 per cent on Irish history, the *baccalauréat général* requires at least 50 per cent on French history, the havo and vwo courses include one component dedicated to Dutch history, and the NCEA Level 3 course can be studied entirely on topics from New Zealand history although this depends on the optional topics chosen. The opposite, with no New Zealand history,

is also possible. Conversely, the Hong Kong HKALE course does not require students to study the history of Hong Kong although the new HKDSE does.

Four courses, the Cambridge Pre-U, the Edexcel A level, the Hong Kong HKALE and the New South Wales HSC, make explicit reference in their aims to stimulating students' interest in or enjoyment of history whilst the Republic of Korea CSAT states that the curriculum is a response to students' requests. All of the courses include students' development of their knowledge and understanding of history as part of their aims, and also the importance of evidence and its critical use.

Only one, the Edexcel A level, mentions the provisionality of history, although others describe historical interpretation as being open to debate. In some the content is more high profile, notably the Matriculation Examination which aims to teach students the principal "trends of Finnish and world history" and New York State Regents Diploma whose predominant emphasis is on "developing a disposition to democratic values and learning to function effectively in American society".

Linked to the study of history, a number of courses argue that one of the aims of studying history is to develop critical thinking skills. This is explicit in the materials supporting the courses for the Edexcel A level, both Hong Kong qualifications, the Denmark STX, the Republic of Ireland Leaving Certificate, the IB Diploma and the New York State Regents Diploma.

The study showed that the assessment objectives of the Edexcel A level are of a similar demand to those of the Cambridge International A level, the IB Diploma and the Cambridge Pre-U. Those for the New South Wales HSC and the Hong Kong HKALE were also judged to be similar to each other but with a slightly lower demand than the Edexcel A level. For example in the case of HKALE there was no reference to historical significance and subject knowledge seemed to carry greater weight, particularly on the examination papers.

The requirements of the People's Republic of China *Gāokǎo*, the New York State Regents Diploma and the Republic of Korea CSAT qualifications have a heavy emphasis upon content rather than on the concepts and processes of history. Similarly the Republic of Ireland Leaving Certificate's assessment objective relating to source handling skills in particular was seen as less demanding, as were the Hong Kong HKDSE assessment objectives. The New Zealand NCEA Level 3 assessment objectives were also considered to be less demanding because they placed less emphasis upon analysis and evaluation.

Two significant differences are the way in which some qualifications describe and assess historical interpretation and the fact that some qualifications limit the extent to which students' understanding of historical enquiry can be assessed, by the absence of a requirement for an extended personal historical investigation. In the former case

some courses treat interpretation and evidence as if they were the same thing (which is not the case). Others understand interpretations in historiographic terms.

In the assessment of students' understanding of historical enquiry, there is a compulsory component of historical enquiry personal research in some qualifications such as the A level, the Hong Kong HKDSE (with the exception of private students) the IB Diploma, the New Zealand NCEA Level 3, the Cambridge Pre-U, the Republic of Ireland Leaving Certificate and in the preliminary school-devised part of the New South Wales HSC.

The more demanding of these require footnotes and a bibliography, and students having to study primary sources in order to gain access to the two highest bands, such as the Cambridge Pre-U and the Edexcel A level.

There is a similarity between the New Zealand NCEA Level 3 historical research internal assessment task, the IB Diploma historical investigation and the Edexcel A level historical enquiry. However it is interesting to note that the New Zealand NCEA Level 3 course has a much more flexible approach to the format in which the task could be presented; for example, designing a museum display for a battle or campaign in the Second World War, or a historical walking tour. The New Zealand NCEA Level 3 course is also unusual in its emphasis that some time should be spent pre-teaching research techniques in order to prepare students to undertake the internal assessment task.

The range and number of topics students actually study can be a key factor of demand. This is different from the range and choice of topics available on qualifications as a whole, as these choices are made by teachers. For students, it all depends upon the minimum requirements determined by the balance between optional and compulsory topics, together with precisely how they are examined. For some of the courses such as the New York State Regents Diploma and the Denmark STX students must cover all topics. The range of topics students must tackle on the Edexcel A level is similar to that on the Cambridge Pre-U and IB Diploma, whilst those on the Cambridge International A level were judged as slightly less demanding.

Having core content gives students some certainty and prior notification of what will be examined. Optional content, on the other hand, gives students the choice to play to their strengths. However this introduces the element of uncertainty about just what will be asked of them. In addition is the degree of choice within an optional topic on the final examination. One final factor here is the extent to which centres or students can devise their own topics. If one takes the view that a lesser degree of choice makes a course more demanding, then the course for the New York State Regents Diploma is most demanding, followed by those for the People's Republic of China *Gāokǎo*, the Denmark STX, the Finland Matriculation Examination and the Hong Kong HKALE and HKDSE.

Assessment

The most common style of question across all courses is the essay, accompanied on the majority by source-based questions. The courses that are significantly different from this model are the *Gāokǎo*, the STX, the *baccalauréat général*, the Regents Diploma, the havo and vwo, the *Vitnemål* and the CSAT.

The Denmark STX has an oral examination. Students have to talk about a subject based upon a set of very challenging sources for 10 minutes and then have a dialogue with the examiner for another 20 minutes. The flexibility and complexity of questioning that such an approach allows was considered very demanding. Having to demonstrate these skills these skills would be valuable to a student looking to progress to higher education in the UK.

Conversely, question styles such as multiple choice, that predominated in qualifications such as the Republic of Korea CSAT, the Regents Diploma and the *Gāokǎo* may not offer students the chance to show what they know more generally, given the specific questions being asked, or to employ analytical techniques. The havo and vwo courses in the Netherlands gave a focus on short-answer questions.

Despite the use of essays across the remaining courses their level of demand is not necessarily the same. All of the essay questions on the *baccalauréat général* paper, many of those on the Republic of Ireland Leaving Certificate and some on the Hong Kong HKALE examination papers do not explicitly ask students to reach judgements, and the Republic of Ireland Leaving Certificate mark scheme appears to reward simple recall. The essay questions on the New South Wales HSC and New Zealand NCEA Level 3 examination papers include the requirement for some description and narrative which are less demanding skills than analysis and argument. In addition, the essay-style questions for the New Zealand NCEA Level 3 are rendered less challenging by being split into two parts (for instance “Explain the factors that led to Oliver Cromwell’s decision to become Lord Protector in 1653”, followed by “Evaluate the extent to which Cromwell’s political and religious aims for the Protectorate were achieved between 1653 and 1658’”).

Of the other courses the essay questions for the Finland Matriculation Examination and the Cambridge International A level have more in common with AS level questions in the UK. The essay question framing is less complex and the word “describe” features more than “discuss”. The essay questions for the IB Diploma were considered to be as demanding as those for the A level, with the exception of the very demanding Paper 3.

On the surface some of the essays for the Cambridge Pre-U appear more complex than those for the A level. However it should be noted that whilst both require students to reach judgements, only the A level questions require the integration of interpretations, perhaps making them the most demanding of all. Finally the single

essay for the Norway *Vitnemål* and the open-ended composition titles for the France *baccalauréat général* were judged to be very challenging due to their open-ended nature. However, the ability of students to select from what they had learned for the former and the lack of explicit demand for higher-order thinking in the latter meant that their overall demand was seen to be slightly lower than A level.

Accompanying the essay questions were source or document questions. Of course the sources or documents that accompanied these questions were not all of the same difficulty. Leaving that factor aside it was possible to discern some clear differences in demand across the courses. The source questions range from simple source comprehension (Hong Kong HKALE and Republic of Ireland Leaving Certificate papers) to the highest level of question requiring source synthesis and the integration of students' own knowledge. This last was present in the A level, the *baccalauréat général* , the IB Diploma and the Cambridge International A level (to achieve an A grade), but not in any other.

Also, the Edexcel A level questions had the added complexity of controversy to deal with. The New Zealand NCEA Level 3 source evaluation paper does demand more evaluation, but some questions include prompts which serve to lessen the degree of demand. The disaggregation of the source questions to target different skills of comparison, evaluation, and so on makes the Republic of Ireland Leaving Certificate questions less complex than the A level questions requiring integration, evaluation and judgement. Some courses made much greater use of scaffolding in source questions such as the New South Wales HSC (particularly ancient history) and the New Zealand NCEA Level 3. On both the New South Wales HSC courses, a significant number of the source-based questions could be answered through factual recall, but others go on to require students to integrate the sources with their own knowledge and some assessment of source utility.

Across the courses examiners have clearly been aware of the need for clarity in their question-writing, so as not to put an additional barrier in front of students. The questions of the New York State Regents Diploma were considered to be particularly straightforward. Across the courses questions were viewed to be clearly written, frequently with consistently used question stems, phrases and command words to make them more accessible to students. The A level is a particularly good example of this, as is the IB Diploma subject booklet.

On the whole the essay questions which predominate across the courses considered as part of this study are similarly structured. Where they are broken into two parts or where a suggested structure or scaffold is given (as in the New Zealand NCEA Level 3) this was considered to lower the level of demand posed by that individual essay, but not necessarily of that essay in comparison to one without any scaffolding structure, because other variables would influence that judgement, such as what the essay question is about.

The only course that was judged to be more demanding for students in terms of the structure of the examination was the Finland Matriculation Examination where students have to decide how many questions (up to six out of the ten) to answer, plus the fact that two of the ten are “wild card” questions which were deemed to be far more challenging and therefore carried higher marks. So this was a very complex set of decisions for students to take.

7.2 History findings by education system

Australia – New South Wales Higher School Certificate, or HSC

The Higher School Certificate (HSC) in New South Wales (NSW) is designed to be studied by the full range of students, rather than only those planning to continue history at university. In the HSC, the study of history is split into two separate optional courses: ancient history and modern history. Both subjects were reviewed as part of this study. Taking both HSC ancient history and modern history uses about 40 per cent of the HSC course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

Ancient history

The supporting materials state that this subject enables students to acquire knowledge and understanding, historical skills, values and attitudes essential to an appreciation of the ancient world; to develop a lifelong interest and enthusiasm for ancient history; and to prepare for informed and active citizenship in the contemporary world. Taking HSC ancient history uses about 20 per cent of the HSC course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

There is scope for teachers to devise their own case studies in the Preliminary course. One key requirement is that students must consider different ancient civilisations to ensure breadth of study. There are significant differences in the scope of the topics. They may arrange an examination of the roles of the historian and archaeologist, archaeological sites, ancient societies and sources. An independent research project is completed at the end of year 11.In the HSC course, content is organised into four units carrying equal weighting. The core unit is a study of archaeological and written evidence of, Pompeii and Herculaneum. For each of the other three units, an Ancient Society, a Personality in their Time, and an Historical Period, there is a range of options (between 10 and 16 choices). These are drawn from the major civilizations of the Near East, Egypt, Greece and Rome.

There are variations in the size of the periods studied. Some topics such as the Old Kingdom Egypt, Dynasties III to VI, cover several hundred years, whereas Greek topics, such as ancient Greece, with much more evidence to consider, may range over 40–60 years. Each topic requires considerable depth and specialisation with a particular emphasis on primary sources, both archaeological and written. An

understanding of the main elements of historiography within the topic is also expected.

The course is assessed at its end in one examination paper of three hours' duration. Section I (Vesuvius) is compulsory; section II (societies) requires one topic chosen from 10 options; section III (personalities) requires one topic chosen from 12 options; section IV (historical periods) requires one topic chosen from 16 options. As questions can be drawn from anywhere within the syllabus topic, students are required to study all of the content in each topic.

The course has both depth and breadth. Depth is achieved by the study of one particular personality and their wider impact. The breadth of the course comes from having to study across two ancient civilisations.

The final assessment for this course takes the form of an external examination and an internal assessment; each worth 50 per cent of the final assessment. The external examination paper is designed as a test for all students of all abilities. It is divided into four sections. Section I has five or six sources accompanied by four questions. The first few involve comprehension and the extraction of information and the last question requires an extended and more evaluative response.

In section II students must attempt one question from a choice of ten questions. Each of these has a single source and four part-questions. Within these two sections there is a heavy emphasis upon knowledge recall.

In section III students must choose one from 12 questions. Each of these is split into two parts requiring short structured essay answers. Students are informed that they must "present sustained, logical, well-structured answers to the question", "use relevant sources to support your argument" and "use historical terms and concepts appropriately" (HSC assessment materials). Part (a) questions generally require straightforward description and explanation. However, the final part requires the development of an argument.

Finally in section IV, students have to choose one essay question from two within their chosen option, of which there are 16. This question requires the development of an argument, supported by evidence and differing perspectives and interpretations. Higher performing students will include discussions of a historiographical nature. The majority of the essay questions in this section ask students to "assess" or "evaluate", prompts which invite judgement and debate. Other questions use the prompt phrase "to what extent" which also necessitates the use of judgement by the students.

Modern history

The supporting materials state that the study of this subject "has a distinctive role in the school curriculum as it challenges students to consider the great social,

technological, economic, political and moral transformations from the late eighteenth century to the present" (Higher School Certificate assessment materials) although from the evidence of the detailed content and examination paper the greatest emphasis is placed upon political history. It requires students to analyse the causes, progress and effects of these transformations and, finally, to make judgements about them. "Modern history is especially relevant to the lives of students, as the events and issues that form its content are, in many cases, still current" (HSC assessment materials). Taking HSC modern history uses about 20 per cent of the HSC course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

Its objectives are that students develop knowledge and understanding about key features, issues, individuals and events from the 18th century to the present; change and continuity over time; the process of historical inquiry; and communicating an understanding of history. Students also develop values and attitudes about informed and active citizenship; a just society; the influence of the past on the present and the future; and the contribution of historical studies to lifelong learning.

In the preliminary course two case studies must be studied, one drawn from: Europe, North America or Australia, and the other from Asia, the Pacific, the Middle East or Central / South America, ensuring breadth. Core study involves the world at the beginning of the twentieth century, using a source based approach. A historical research project is also undertaken. The content is organised into four parts and is based exclusively on 20th-century history, with a heavy emphasis upon political history. There is a wide range of topics. Part I is a compulsory source-based study of World War I focusing on Europe. The other three parts, national studies, personalities of the 20th century, and international studies in peace and conflict have a wide range of options within them. This optionality means that whilst a breadth of coverage is possible the converse is also feasible. For example, it is possible to concentrate exclusively on European history between 1914 and 1945 by taking the following options: World War I (1914–19), Germany 1918–39, Albert Speer and conflict in Europe 1935–45. It is also possible to devote half of the course to Northern Ireland by studying Ian Paisley and Anglo–Irish Relations 1968–98, although the examiner's report shows these two options are rarely chosen.

There is one final examination paper at the end of Year 12. Section I has three compulsory questions on the core unit on World War I. Section II has two questions on each of the national studies from which students choose one. Section III has one question per personality studied, so students have no choice unless they have studied more than one personality. In Section IV, there are two questions offered per period from which students choose one. So students will need to have covered all of the chosen topics.

Like the ancient history subject, the assessment for this course takes the form an external examination in Year 12 and an internal assessment, each worth 50 per cent of the total assessment.

The external examination paper is designed as a test for all students of all abilities. It is divided into four sections. Section I has three questions that relate to the four sources in the accompanying source booklet. The source questions are scaffolded and involve comprehension and the extraction of information rather than inference or evaluation. Only the final question targets source utility. In Section II students have to choose one essay question from the two within their chosen option, of which there are nine. The vast majority of the essay questions in this section ask students to "assess" or "evaluate"; prompts which invite judgement and debate. Other questions use the prompt phrase "to what extent", which also necessitates the use of judgement by the students. However, in the same paper there are questions which use the prompt words "explain" or "account for" which do not require an assessment of the relative importance of the various factors which explain or account for a particular development.

In Section III students must answer one question which can be on any one of 27 named individuals. Each of these questions is split into two parts, the first requiring short structured essay answers. Students are informed that they must "present a sustained, logical, well-structured answer to the question", "support your argument with relevant, accurate, historical information" and "use historical terms and concepts appropriately" (HSC assessment materials). The part (a) question requires the relatively undemanding outline / narrative of a life. However, the final part (b) requires the development of an argument based on the given individual. The question asks students to assess the accuracy of the statement that "individuals are the product of their times" in relation to their chosen individual. This question requires the development of an argument, supported by evidence and differing perspectives and interpretations. Higher performing students may include discussions of a historiographical nature.

In Section IV students have to choose one essay question from two within their chosen option, of which there are seven. The vast majority of the essay questions in this section ask students to "assess" or "evaluate"; prompts which invite judgement and debate. Other questions use the prompt phrase "to what extent" which also necessitates the use of judgement by the students.

Denmark – *Studentereksamen*, or STX (Upper Secondary School Examination)

The *Studentereksamen* (STX) is designed to be studied by students intending to continue their academic studies at university. Students must do well in their lower secondary courses in order to be accepted for STX. History is a compulsory component of the STX. This study reviewed History A in the STX Upper. All students take the History A course within the STX which uses about 10 per cent of the STX

course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The supporting materials state that the history course is designed to develop students' knowledge of history, historic consciousness (a term used in a number of European countries – to mean an awareness of the historic past) and identity. The subject gives students the means to evaluate various types of historical material, and work with and structure the many ways in which history is presented and used both in and outside school. Through work with historical material, students develop their critical, analytical and creative abilities.

When assessing performance, importance is placed on the extent to which the examinee's performance lives up to the subject aims which are to: "account for central events and developments in Danish, European and World history (including the connection between national, regional, European and global developments); document knowledge of different types of society; formulate historical problems and relate these to their own time; analyse the symbiosis between humans, nature and society through the ages; analyse examples of the connection between material conditions and human aspirations; explain changes in society and discuss the principles of the various periods; reflect on mankind as being created by and creators of history; collect and systematise information on and from the past; work with different historical materials and comment methodically and critically on examples of the use of history; show historical insight in various ways and give reasons for them; and demonstrate knowledge of the identity and methods of the subject" (STX assessment materials).

Time periods from pre-1453 to the present day are covered. Although there is flexibility in terms of how this broad range of topics is taught all must be covered. At least two stages have to be based specifically on Denmark's history, one in the period before, and one after, 1914. Stages based on Denmark's history should also have an outward view of European history and / or world history, and stages based on Europe's history and / or world history should be prepared with an insight into Denmark's history.

The assessment of the course is continuous with an evaluation after each stage. At the end of the course there is an oral examination. Although only one topic is assessed in this oral examination, students do not know which topic this will be until it is decided by a lottery 24 hours before the examination. Therefore they must have covered all topics, so the course ensures a broad range of topics is covered.

The oral examination lasts 30 minutes based on 10–15 pages of pre-released material. These materials relate to one of the 15 stages of the curriculum covered and comes in a variety of formats, including tables of data, pictures and extracts of text. In the oral examination, the student has to set out, analyse and discuss one or

more issues connected with the topic that they are allocated. In the first ten minutes the student presents the historical problem(s) and their relationships with the completed stages. The examination then continues in the form of a 20-minute dialogue between the examiner and examinee.

The examination and course itself link well to the aims; they include a focus on events and developments in Danish, European and world history, and the nature of the assessment task would seem to fit particularly well with the aim that students should be able to "formulate historical problems and relate these to their own time".

This is accessible for students of varying abilities, and provides opportunity for higher attaining students to demonstrate their knowledge and skills. The preparation for an oral examination such as this is a useful skill.

England – A levels

The A level is designed to be studied by students who were successful in level 2 history and wish to continue their studies although not necessarily to study history at university. After completing half the course, students may claim a qualification called the AS level, with the second half of the course being called A2. Together they make up the A level. A levels are offered by five different organisations in England, and they contain some variation although they are based on a common set of criteria set by the regulator. Taking history A level typically uses about 30 per cent of a student's A level study time. History is a subject choice within A levels. The A level specification considered for this review is offered by Edexcel. This specification offers a choice of content including British, European and world history, with options covering areas such as medieval England and the British empire. It should be noted that this is teacher choice, not student choice.

There are two assessment objectives. The first includes the requirement for students to:

- recall, select and deploy historical knowledge appropriately, and communicate knowledge and understanding of history in a clear and effective manner
- demonstrate their understanding of the past through explanation, analysis and arriving at substantiated judgements of key concepts such as causation, consequence, continuity, change and significance within an historical context and of the relationships between key features and characteristics of the periods studied.

The second includes the requirement for students to:

  - as part of a historical enquiry, analyse and evaluate a range of appropriate source material with discrimination

- analyse and evaluate, in relation to the historical context, how aspects of the past have been interpreted and represented in different ways.

The content is organised in four units containing a varied range of nearly 100 topics from ancient history to the present day. Within this choice there is some prescription as students must study the history of more than one country or state or the history of more than one period. There is a compulsory British history depth study unit weighted at 25 per cent and Unit 4 Historical enquiry includes consideration of both short-term and long-term change within a period of at least 100 years. Moreover duplication is avoided by having prohibited combinations. Three of the units are externally assessed and the last, Unit 4, is an internally assessed historical enquiry carrying 20 per cent of the total assessment weighting. The external examinations amount to four hours 40 minutes in total duration.

The examination for Unit 1 Historical themes in breadth is 1 hour 20 minutes long and carries 25 per cent of the total assessment weighting. Students answer two essay questions chosen from the six or seven topics. Each question must come from a different option topic. Most of the examination questions in this unit begin “How far…” or “To what extent…” and test a student’s ability to “demonstrate their understanding of the past through explanation, analysis and arriving at substantiated judgements”.

The examination for Unit 2 British history depth studies is 1 hour 20 minutes long and carries 25 per cent of the total assessment weighting. Students must answer one compulsory source question from their chosen topic and then choose one source plus own knowledge essay question from a choice of two. This last is very demanding as it requires students to make reasoned and supported judgements regarding an historical view or claim, drawing upon both the sources and their own knowledge. One area of uncertainty here is the distinction between a source and an interpretation. For each question whilst one is a source the other two extracts are historians’ views or interpretations of the history.

Unit 3 Depth studies and associated historical controversies has a two-hour examination which carries 30 per cent of the total assessment weighting. Students answer questions on one sub-topic in each option. They have to answer two questions: in section A they choose one essay question out of two and in section B they do the same. These look at the nature of challenges and conflict, and the use of sources as evidence to make judgements on historical controversies. These questions were judged to be the most demanding questions seen on any of the qualifications reviewed, making this the most demanding paper.

The questions are appropriately demanding, and allow high-achieving students to demonstrate their higher-order skills. They require students to create and justify opinions and judgements.

Finland – *Ylioppilastutkinto* or *Studentexamen* (Matriculation Examination)

The Matriculation Examination is designed to test students' level of achievement in their upper secondary studies. An overall pass entitles them to continue their studies at university. History is an optional subject choice and is intended to occupy a quarter of students' study time over two years if it is selected. Taking both the compulsory and specialised additional history courses within the upper secondary school programme uses about 10 per cent of the Matriculation Examination course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The stated objective of teaching history is for students to learn principal trends of Finnish and world history and the most important events in history and their backgrounds and consequences; to perceive the present as being the result of historical development and the starting point for the future, to be capable of relating their own time and themselves to the continuum of history and thus be able to build their knowledge of history; to be able to acquire information about the past and assess it critically, understanding its ambiguity, relativity and the intricacy of its causal connections, to be able to assess human activity in the past and examine historical phenomena both from the starting points for each period and from the present day perspective; to understand different manifestations of culture and their diversity; and to obtain material to create a world view which appreciates human rights and democracy and to act as responsible citizens (Matriculation Examination assessment materials).

In the course there are different types of history to study and examples of studies in depth, as well as historical overview, although the balance tends more towards breadth rather than depth of study. The course content is divided into four studies and two advanced special studies. Students can either study the first four or all six. Each is organised chronologically and contains a mix of social, economic, political and cultural history. These are: History 1: Man, the environment and culture, and History 2: European man. These start from prehistory and the classical era respectively, and are followed through to the present day, with a largely European perspective. History 3: International relations is 20th-century international relations including both World Wars, the Cold War and through to the present day; History 4 is modern (19th- and 20th-century) Finnish history. The Advanced special studies are History 5: Finnish history from prehistory to 1809, a mix of social, economic, political, cultural history; and History 6: Meeting of cultures, which lists a number of societies across time and space. This last is less precisely defined that the other five studies. A minimum of a quarter, and possibly as much as a third, of students' time might be spent studying their national history.

The final examination is sat on a national test day, and the paper has ten questions, including questions from all six topics. Included in the ten are two demanding "wild

card" questions and a maximum of four "cross-subject" questions. Students can answer up to six questions. If a student answers more than the six required questions then all are marked and the lowest six scores awarded. If more than one answer to a question is submitted then the answer with the lowest score will be accepted.

The ten questions use a variety of approaches, some with a source and some not. Eight are designed to have comparable weightings, a maximum of six marks, and the other two "wild card" questions have a maximum weighting of nine. Not all the assessment objectives for the course could be covered by the questions, but the course does encourage teachers to undertake additional testing throughout the course.

There is a wide degree of variation of demand between the questions. Although all questions are challenging, there is a variety of history skills being tested; some more demanding than others. Some have an emphasis on description or causation, which might be more accessible to the lower-attaining students while other questions are testing interpretations and evaluating source materials, which allow higher-attaining students to demonstrate their abilities.

Many questions on the paper actually require students to consider two aspects, for example one question asks how man changed nature in a certain period AND the consequences of this. This two-part approach to questions also makes them more demanding, particularly in structure and approach, although it may also be a deliberate attempt at differentiation within a question, as often the first requirement is less demanding than the second. The effect of the variation in question style within a single paper, which is divided into optional sections, appears to reduce the extent to which students making different choices have comparable challenges. Overall, however, the open nature of many of the questions must successfully challenge the most able students.

The mark scheme is unusual when compared with that of the A level. The examination is marked on a standard assessment scale of 0–6 inclusive, or for wild card questions, 0–9. There is no explanation of the qualities relating to each mark and no reference to assessment objectives; however, there are two lists to help teachers in their marking, one demonstrating the criteria of "an answer indicating maturity" and one demonstrating criteria of "a poor answer". Further, there appears to be a negative approach to marking as evidenced by the comment that markers should (using a red pen) underline any errors and make notes in the margin next to long passages that contain errors or irrelevant material. Also if an answer is unclear, confused or remarkably untidy, its score may be reduced.

France – *baccalauréat général*

The *baccalauréat général* is designed to be studied by students who were successful in the *diplôme national du brevet* and plan to continue their studies at university. History is part of the subject history–geography in the *baccalauréat*, and is a compulsory subject in all three streams: sciences, economics and social sciences and literature. Taking both compulsory and specialisation courses for the joint subject of history–geography within the *baccalauréat général série* ES uses about 20 per cent of *baccalauréat général* time. Study load within the course is split between history and geography. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The content of the course varies depending on the stream students are taking, but overall the aims of the examination are:

- to assess the aptitude of the student to state his / her knowledge and ideas of the programmes, fundamental knowledge and comprehension of the contemporary world, the civic and cultural training of the citizen
- to evaluate the acquisition of skills throughout their secondary education, in particular the capability of the student to treat and grade the information, to develop a reasoning of history or geography, according to the proposed forms of written or graphic submissions of text by the different parts of the test
- an appreciation of the quality of the student's written expression, as well as their acquiring of judgement by demonstrating the skills of critical reading, analysis and the interpretation of a range of sources.

Whichever stream students are following, French history constitutes about 50 per cent of their course. The topics cover a narrow chronological range. The international dimension is provided by studies of European history, the USA and the USSR. The "third world" is included in one of four sub-topics in the first topic of the economics and social science and literature series' final class.

Each of the three series of *baccalauréat général* is assessed by a written terminal examination accounting for 100 per cent of the mark. Students take the appropriate paper for the series they are studying. The four-hour test is divided into two unequal parts and on the day of the test, the headteacher of the school or college decides which subject (history or geography) will be the subject for the first part. The second part then has to be the other subject.

In Part 1, students can choose either one of the two extended writing composition questions or the more structured source question, which itself contains a composition question. All three carry the same weighting of 12 marks and are designed to match one area of the syllabus. The demand of the composition questions lies in their very

openness; however the accompanying mark schemes do not specify higher-level thinking being required for higher marks. However, the lack of any command words could reduce the demand as effectively the instruction is to "write about" a given topic. The openness of these questions allows for differentiation by outcome as students of all abilities will write what they know and understand. However, higher-attaining students may simply be rewarded for writing more, or in more detail, demonstrating more knowledge rather than showing more complex higher-order skills. Given the large amount of time available it must be assumed that students are expected to write in some detail and this may be more challenging for lower-attaining students. It certainly tests some of the cited objectives such as "fundamental knowledge", "understanding" and "mobilise knowledge and ideas". Students are also rewarded for "quality of expression" which this type of question can allow them to demonstrate.

In part 2, students can choose to answer one from two source-based questions each with five sub-questions requiring use of the source and own knowledge. Each full question is worth 8 marks. These types of questions successfully meet the remaining objectives of critical exercise of reading and analysis and interpretation of source documents and different natures. In this way there is a good match between questions and assessment objectives; however, these objectives are rather broad and do not necessarily test students' abilities in higher-order skills such as reaching judgements, testing interpretations, cross-reference of sources and creating arguments. In the science stream examination the questions are quite narrow in their focus and answers potentially seem to be either right or wrong. The most demanding questions are potentially the source questions in the economics and social science and literature stream examinations which require students to demonstrate skills such as identifying and explaining different interpretations. For example, one part-question on an advertisement from the economic and social committee of the Centre-West (CSECO) 1962–3 requires students to "Unravel and class the arguments used" (*baccalauréat général assessment materials)*.

The marking guidance for part one is very general, giving a very brief description of the awarding of overall marks for the examination but it is stressed that this is just a guide. For part 2, the source-based questions, a similar format is followed although here more guidance is given on what should be in an answer. It is interesting to note that regarding the source sub-questions, it is expected that students answer some questions, to a maximum of five, therefore implying that answering all the questions is not necessary.

Hong Kong Advanced Level Examination, or HKALE

The HKALE is designed to be studied by students who were successful in the Hong Kong Certificate of Education Examinations and wish to continue their studies, although not necessarily to study history, at university. History is an optional subject

within the HKALE and is comprised of two syllabuses, A and B, either of which can be studied as an AS level qualification in one year, or together form an A level qualification. In both syllabuses political issues dominate; though in syllabus A there is an extensive section on economic, social and cultural issues.

A typical HKALE student taking A level History alongside four AS subjects uses about 30 per cent of course time for the A level. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The objectives of the course are to help students to:

- recognise significant historical trends and developments that have shaped the modern world
- establish plausible relationships between facts and events, demonstrating the appropriate use of historical concepts and generalisation
- compare the various forms of historical evidence, noting contrasts, similarities and recognising bias in and discrepancies between source materials
- make critical use of historical data in support of arguments and judgements
- read, locate and summarise relevant information from a variety of materials and present information in a logical, analytical and coherent structure both orally and in writing
- distinguish, question and assess different approaches to interpretations of and opinions about the past
- apply relevant historical knowledge or understanding to daily experience both direct and indirect
- identify and appreciate problems and challenges faced by societies in the past as well as values and attitudes on which human actions have been based
- develop and maintain an interest in the pursuit of historical enquiry (HKALE assessment materials).

Syllabus A is Modern Western History (c.1800–1980) which is organised under four broad themes. Within these there are 16 topics. Syllabus B is Modern Asian History (c.1800–1980) which is organised under five countries / regions as these “do not have the same degree of commonality with respect to their historical development’” (HKALE assessment materials). A broad survey approach supplemented by in-depth studies of topics / countries is intended. Teachers can “trade breadth for depth”, and as such are not expected to cover all topics, for example in Syllabus B there is an assumption that two regions from the five on offer will be taught.

For each paper, there is an examination of three hours' duration which appears adequate for the demands of the papers. Each examination is in turn split into two parts. Part I consists of compulsory data-based questions related to the nominated topic. Various types of historical sources may be used, including extracts from written sources, statistics, and visual material such as maps, cartoons and photographs. Part II consists of 15 essay questions from which students choose two.

There is a clear incline of difficulty in part I which makes it accessible to all and the final question gives scope for higher-attaining students to demonstrate their knowledge and skills.

The essay questions in part II are sufficiently open to challenge the highest-attaining students, but the specificity of questions may occasionally act as a barrier to some students and prevent them from being able to demonstrate their knowledge and skills. For example on the topic of South-East Asia, which includes seven countries, just one (Siam) is made the focus of the examination question.

The two papers are almost identical there is a very narrow assessment pattern.

Hong Kong Diploma of Secondary Education, or HKDSE

The HKDSE is designed to be studied by the full range of students, rather than only those planning to continue history at university. History is an optional subject within the HKDSE. Taking history within the diploma uses 10 per cent of HKDSE course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The syllabus aims to help students to:

- discover where they stand in contemporary world
- develop skills of critical thinking
- approach past and current events in an impartial and empathetic manner
- understand characteristics and values of their own culture
- cultivate both national consciousness and being citizens of the global community
- explore in greater depth an issue of personal interest (HKDSE assessment materials).

The content of this subject is focused upon modern political history. A student completing this qualification over three years would have a breadth and depth of knowledge and understanding of international history in the 20th century. The major focuses are upon Asian history (Hong Kong, China, Japan and South-East Asia), and

upon conflict in the 20th century which has a European and global superpower emphasis, although the conflicts in some other regions of the world are also covered, namely the Middle East and South Africa. There does not appear to be any opportunity for students to consider in any depth the history of any countries other than those of South-East Asia, or periods other than the 20th century, nor do they have the opportunity to contrast the historical development of their own area with that of other countries and civilisations.

There is a large number of topics, each covering up to 100 years of history in some depth although there are overlaps between them to lessen the challenge. Due to the pattern of the final assessment centres will essentially need to cover everything. The school-based assessment (SBA) requires students to design and answer their own question, taken from the 20th century, and meeting the requirements of at least one of three approaches described in the course materials: comparative, issue-based or local heritage studies. This component allows students opportunities to consider aspects of economic and cultural history and could lead to opportunities for very interesting work.

The final assessment for this course is in two parts, two examination papers and the SBA, although private students do not complete this component.

In Paper 1 the questions cover source evaluation and interpretation and consideration of the perspective of people in the past. In terms of demand there is quite a range of questions. In particular there are accessible questions for the lower-attaining students such as question 2a which simply tests source comprehension skills. There is also a large number of source-based questions on this paper which ask students to discuss limitations, bias and inference and these are of low demand. There are a few more demanding questions which require an extended written response and synthesis of sources and own knowledge which are more demanding but the limitations of time and expected outcomes are below those expected at A2 of the A level. Bearing in mind that this paper represents 50 per cent of the total assessment this significantly lowers the total demand of this history element of the qualification.

In Paper 2 the questions are targeted at knowledge, understanding, selection and deployment and historical terms, skills and concepts. These are more demanding questions, in part because of the extended writing response required of students. However students only have roughly 35 minutes for each question which limits the depth of response possible. Question stems show that different skills are being tested by different questions, for example some ask for comparison, some for consideration of named factors and others such as question 4 ask students to “trace and explain” development. There are quite significant differences in the time periods covered by questions so for example question 6 focuses on the second half of the

20th century whereas question 4 targets the entire century. Bearing in mind the different geographical spheres these may represent a comparable level of demand.

Taken together the papers provide insufficient opportunity for students to demonstrate the higher-order skills that would be needed as part of further study.

International Baccalaureate Diploma

The International Baccalaureate (IB) Diploma programme is designed to prepare students to continue their academic studies at university. History is one of the subject choices within Group 3: Individuals and societies as part of the IB Diploma. Taking higher level history within the diploma uses about 20 per cent of the IB Diploma course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

There is a wide range of topics available for study. There are two routes: route 1 on developments in the history of Europe and the Islamic world (500–1570) and route 2 on 20th-century world history. Teachers must choose one of these routes. It is not possible to study topics from both. The range of geographic areas offered in the topics and the topics themselves are very broad, for example “causes, practices and effects of wars”. The prescribed subjects for Paper 1 provide the opportunity for in-depth study of a particular topic, and the choice of topics on offer for Paper 2 is very wide. The flexibility and choice allows teachers to choose a topic that links with their choice of prescribed topic if they wish. For route 2 the examples for detailed study selected must cover two regions, which ensures coverage of a range of geographic areas. This is an international qualification and there is less emphasis on students’ own national history, but there is scope to be able to cover this thoroughly in Paper 2, Paper 3 and the internal assessment task.

There are no forbidden combinations so it appears that it might be possible to choose a narrow route through the materials. The free choice of topic for internal assessment also has implications in this respect. There does not seem to be any mechanism in the syllabus itself to prevent students from choosing to investigate an aspect of history, such as the crisis of communism, which they may have studied for Papers 1, 2 and 3.

The course is examined at the end of the second year, and the routes have the following assessment patterns:

- Route 1: two compulsory papers at standard level, and three compulsory papers at higher level. Paper 1 (source-based paper), one topic from a choice of two options. Paper 2 (essays), two topics from a choice of five options. Paper 3 (essays), three topics from a choice of 12 options.

- Route 2: two compulsory papers at standard level and three compulsory papers at higher level. Paper 1 (source-based paper), one topic from a choice of three options. Paper 2 (essays), two topics from a choice of five options. Paper 3 (essays), one region from a choice of four, then three sub-topics from a choice of 12 options per region.

In both routes, the source-based papers contain short answer / structured questions with a clear incline of difficulty, moving from source comprehension to synthesis of sources and own knowledge in evaluating a historical claim and in essay questions of a similar type, although the nature of demand varies, for example “analyse”, “compare and contrast”, “examine”. The glossary of command words makes the demand of these questions clear and appropriately challenging. Some questions are presented in two parts as (a) and (b) which offers some support to students, and might be considered to reduce the level of demand.

Many of the essay questions are very open-ended, which allows for differentiation by outcome. The language used is accessible to both lower- and higher-attaining students. The questions provide an excellent opportunity for higher-attaining students to demonstrate their skills and knowledge. For example, one question asks students to “analyse the circumstances that helped one right-wing leader to become the ruler of a single-party state”. This question can be answered with widely different levels of sophistication. Conversely the emphasis on the recall and organisation of knowledge in the more straightforward questions would also render them accessible to lower-attaining students.

While it is possible to cover a narrow range of topics across this course, the assessments would allow students to demonstrate the higher-order skills they had developed through the course, making it comparable in demand to A levels.

Netherlands – *hoger algemeen voortgezet onderwijs*, or havo and *voorbereidend wetenschappelijk onderwijs*, or vwo

History is a compulsory subject in the culture and society profile and in the economy and society profile of both the havo and vwo qualifications. Requirements for both qualifications for history are the same, and have therefore been reviewed together. Taking history within the havo programme uses about 15 per cent of havo or vwo course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The course has assessment objectives which are expressed as fields. There are five of these: A – Historical understanding; B – Orientating knowledge (in a chronological development of centuries of European history); C – Topics (chosen by schools); D – History of the constitutional state and parliamentary democracy; and E – Orientation to study and career (further training opportunities in history).

Students study all five fields. Fields B, D and E are assessed in school. Fields A and C are assessed by the central examination. Within Field A, students are given an extensive and broad overview of history from pre-3000 BC through to the end of the 20th century, divided into ten epochs, examining the broad characteristics of each epoch. For each, students have to be able to name the characteristic aspects, give a suitable example of an event, development, phenomenon or action or reasoning of a person for each aspect, and use this example to elucidate the aspect in question; they have to be able to explain how knowledge of the era concerned influences the attitude towards present reality; and be able to explain that the significance that is attributed to eras depends partly on the time, place and circumstances in which people engage with the past. Some of the concepts developed through this Field are very sophisticated and challenging, for example the emphasis on developing "an understanding of the subjective nature of chronological frameworks" (Field A3) or the "simultaneousness of the non-simultaneous". This extremely demanding approach contrasts with the examination papers which appear to require only a superficial knowledge from students.

Within Field C students study two compulsory topics: decolonisation and cold war in Vietnam; and dynamism and stagnation in the Dutch republic (from the late 15th to early 19th century). The outline of content in these is demanding in its detail. Students are required to study concepts such as change and continuity, cause and effect, and skills such as source analysis, the ability to formulate questions, the ability to distinguish between fact and opinion and how to support arguments with evidence.

The qualification offers an opportunity for teachers to design their own courses and to decide when and how they assess, but this freedom is balanced against the centrally assessed Fields which offer little choice. There appears to be a strong euro-centric focus to the course; however it has a strong component of social and cultural history as well as political history.

The final assessment for this course consists of the central examination and the school examination. The school examination must be completed and the results submitted to the Inspectorate before the national examination starts.

The assessment approach in the national examination is very different from that found in A levels. The two subjects / topics for the national examination are published in advance (for 2011 they were dynamism and stagnation in the Dutch republic and decolonisation and cold war in Vietnam). The examination consists of 30 short-answer questions based upon a number of sources. The questions vary in demand, with some requiring recall only and others requiring the analysis of a source in order to use it to support four different propositions. The questions are clear in their demand and focus as shown by the consistent use of command terms such as, "indicate", "name" and "explain", and the questions themselves are concise and uncomplicated.

There is an opportunity for extended writing in the school examination. However on the national examination there is no extended writing, historiography or serious analysis. Further, the amount of required historical content for the national examination is less than that required in the A level.

New Zealand – National Certificate of Educational Achievement (NCEA) Level 3

The National Certificate of Educational Achievement (NCEA) Level 3 is designed to be accessible to the full range of students rather than only those planning to continue their studies at university. History is an optional subject within the NCEA. The course has five achievement standards. Taking NCEA Level 3 History uses about 20 per cent of NCEA course time, because a student typically studies five subjects. In England a typical student takes three A levels using about 30 per cent of course time per subject.

- Plan and carry out independent historical research which involves independently defining an area for historical research; planning the research; selecting and recording, in an organised way, relevant historical evidence from a range of sources; and evaluating the effectiveness of the research process.
- Communicate and present historical ideas clearly to show understanding of an historical context which involves communicating key historical ideas with accurate supporting evidence to show understanding of an historical context. It also requires material to be presented clearly, applying appropriate historical format and / or style to the mode of presentation and using appropriate historical conventions consistently and accurately.
- Analyse and evaluate evidence in historical sources which involves demonstrating an understanding of historical ideas and / or recognising differences in points of view. It also requires analysis of historical relationships indicated by the evidence and making valid judgement(s) about the usefulness and / or reliability of the evidence.
- Examine a significant decision made by people in history which involves writing an essay accurately, describing factors that contributed to a significant decision made in an historical setting and the consequences of the decision.
- Examine a significant historical situation in the context of change which involves writing an essay to examine a significant historical situation by describing the situation, change in the situation over time and the influence of the situation on people.

(New Zealand assessment materials)

The compulsory historical content areas are New Zealand history in the 19th century and Tudor and Stuart England, 1558–1667. While having few compulsory areas may allow greater depth to be achieved, it is possible that choices made could result in students only studying national history, and not getting the opportunity to gain

awareness of cultures outside England and New Zealand, or to study more recent history (although they do have the opportunity to study local history). However, the independent research units offer a potential counterweight to this.

The history course will see significant changes to its content under the new curriculum introduced in 2010, with the first NCEA Level 3 assessment taking place in 2013. In particular the externally assessed standards will no longer be constrained to New Zealand history in the 19th century and Tudor and Stuart England, 1558–1667.The final assessment for this course consists of students undertaking three assessments from five available assessments. Two of these are internally assessed and three are externally-marked examination papers. The internal assessments require students first to plan and carry out independent historical research and then to communicate and present that research in context. These offer innovative ways of assessing students' understanding of the issues.

All three externally assessed standards are examined in one examination sitting.

The three examinations are all set in relation to either the topic England 1558–1667 or 19th-century New Zealand. The first examination is entitled "Analyse and evaluate evidence in historical sources". It consists of six unseen sources with six equally weighted questions. Each question focuses upon a different type of source skill, such as describing the significance or meaning of something in the source, explaining different points of view in different sources, explaining the cause and effect of an issue or theme in the source, making connections between past and present, and evaluating the usefulness and / or reliability of a source. Many of these questions use the sources as prompts to explore an issue, and utilise the student's knowledge of the period rather than source skills as such. The sources are unconnected so there is no question requiring students to synthesise and this makes the paper less demanding.

The second examination is titled "Examine a significant decision made by people in history". Students choose one essay question from six on their chosen topic. These questions focus on cause and consequence. The questions are structured in a way that these ideas are dealt with separately within an overall essay response.

The third examination is titled "Examine a significant historical situation in the context of change". Students choose one essay question from six on their chosen topic. These questions focus on change and continuity. The questions are structured so that there are two sections within the essay response. The first part deals with describing the situation, and the second part evaluates the impact of change.

The essays offer a good level of demand but are structured in how students can respond, and more importantly they do not directly require the application of higher-order skills. For example, questions that ask students to "Explain the factors that led

to… / contributed to…" and to "Evaluate the consequences of…" could produce narrative rather than argued responses. In another question students are asked to describe an event or issue, before evaluating its impact. Lower-attaining students will benefit from the structured questions and may choose recommended approaches to the independent research task which do not perhaps demand higher-order skills. Higher-attaining students are less well served (due in part to less challenging question stems and an absence of questions on interpretations).

Students are provided with a suggested outline structure for the essays (introduction / body / conclusion) which may prove useful in improving access, as may the planning sheet. However it could also be argued that these could prove counter-productive and that encouraging students to copy out the question is not good use of their examination time. It could also be argued that some of the additional wording designed to improve clarity may be unnecessary or clumsy such as the question, "Examine a significant decision made by people in history, in an essay".

Compared with the A level, the mark scheme is different. It is non-numerical with three levels of achievement only (or four, including the "non-achievement" level), and this is based on the quality of responses rather than by attributing marks based on individual elements.

The Ministry introduced a new curriculum for schools in 2010, which has resulted in a re-alignment of the NCEA achievement standards across all three levels. These will be implemented fully in 2013 with new standards at NCEA Level 3. The analysis and findings in this study are based on the outgoing standards which will be examined for the last time in 2012.

Norway – *Vitnemål fra den Videregående Skole* (Certificate of Upper Secondary Education)

The *Vitnemål fra den Videregående Skole* (Certificate of Upper Secondary Education) general studies programme is designed to be studied by the full range of students, rather than only those planning to continue history at university. History forms part of the history and philosophy course. Taking both joint history and philosophy courses within the upper secondary school programme uses about 10 per cent of *Vitnemål* course time. In England a typical student takes three A levels using about 30 per cent of course time per subject.

Its aim is to:

> give pupils training in source criticism and the ability to evaluate information, and in distinguishing between information and documentation. These skills are crucial to democracy, the rule of law and science, and to an active participation in the Information Society. This programme subject shall help develop the individual's awareness of history,

> and the ability to participate in philosophical discourse and wonder about how humans have lived and behaved throughout history.
>
> (*Vitnemål* assessment materials)

The qualification is seen as providing a general education, increasing the student's own self-awareness and also providing a base for study at a higher level.

The course does not have explicit assessment objectives. Instead there is a statement of competence which encompasses four specific criteria. The first three of these are historical and philosophical knowledge; historical thinking and consciousness and philosophical reflection. The fourth is historical and philosophical knowledge; historical thinking and consciousness and philosophical reflection. Then there is use of sources, which is assessed on the use of sources, and two more general criteria, "are the required sections answered"; and "the overall evaluation based on the general criteria: relevance, independence, technical knowledge, consistence and argumentation" *Vitnemål* assessment materials). These are a mixture of competencies and the characteristics of an examination answer. When expressed in relation to each subject area these appear to be content and / or process driven, for example "compare social constructions" or "assess the value of selected historical artefacts and narratives as sources of knowledge about different themes in the Middle Ages" but with a dimension of historical skill in some, for example "apply relevant source criticism and questioning…".

The syllabus content has a very wide chronological approach from early civilisations and the ancient world through to the modern day over the three-year course. There is a strong emphasis on European and Norwegian history throughout although there are also references to wider European and non-European history, for example a focus on "aboriginal culture'" to illustrate conflict between traditional and modern cultures. Throughout there is also a focus on different types of history – economic, philosophical, social, political and cultural, but as the title suggests it is the philosophical approach which receives most attention. Key events are also named specifically for study such as Greek and Roman civilisation and the significance of Islamic culture in the Middle Ages, but what is particularly noticeable about the content of this qualification is the flexibility available to centres and students regarding which particular nations and events to study, for example in History and Philosophy 2, "discuss the meaning of modernisation and give examples of this from different parts of the world". Thus it is the understanding of history skills, concepts and terms that is important, with content used to illustrate, supported by the specialisms of centres, teachers and students.

All of the main subject areas of the course are core and compulsory and have considerable breadth, although the degree of depth is not clear. There appear to be no options at all in the syllabus. However the option that is available to centres is the

freedom to choose the particular nations and examples that they teach to exemplify the bullet point indicators in the syllabus.

School-based students may be selected to sit the final examination. For those that do, the final examination is an essay constructed in broad terms to allow students to bring to bear the understandings they have developed. They are also allowed a day's preparation time to familiarise themselves with the subject material which must form part of their response. Beyond that requirement they can draw upon whatever topics their teachers have chosen to study in order to explore the key understandings of the qualification. It appears that all external students sit the oral and written examination, but only a selected sample of the school-based students need to do so. It clearly forms a moderation or verification role for school-based students. As such the examination does not attempt coverage of the course of study, or require chronological breadth in the response. Rather, it appears to be a light-touch test of the level of competence of selected students, as a means of validating teacher assessment of the course as whole.

Students may be required to sit an oral examination at the end of History and Philosophy 1. (No examples of the oral examination were seen.) They may be required to sit a written examination at the end of History and Philosophy 2. The written examination consists of a single question which is very much an overarching question about the nature of history itself that gives students the opportunity to draw upon virtually anything that they have studied. It does relate very directly to one of the subject areas of History and Philosophy 2. The question asks about "truth", which matches the subject area "Knowledge and the pursuit of truth". Whilst it does ask for the specific inclusion of the Holocaust, students are told this in advance and are able to research this as part of their pre-examination preparation day. This means that it is not a test of memory. In some ways, therefore, it compares with the controlled assessment at GCSE in terms of its methodology in that students have sufficient time, in an open-book situation (including internet access), to prepare for a question on a specific area of their course. Whilst the precise question is not given in advance on the preparation day it is so broad that it allows a wide range of response.

Nevertheless the one task set is very demanding in its conceptual requirements, and higher-attaining students have ample opportunity to demonstrate their knowledge and skills. The preparation time and additional points scaffolding make it accessible to lower-attaining students. The length of time is appropriate for the assessment itself, but appears much more demanding than the assessments undertaken for A level if it requires greater complexity and greater conceptual understanding to be displayed rather than simply doing more. In the absence of student work this cannot be tested further. It should also be noted, as above, that this task is comparable in some respects to the controlled assessment tasks undertaken at GCSE in that the students know the area of the question in advance to prepare and can have their

preparatory notes with them when they write their final answers under examination conditions.

There is no mark scheme as such, but an evaluation matrix is included at the end of the assessment materials. In essence it is a fairly simple level of response mark scheme. It gives no detail or illustrative examples, and, after the initial definition of the competences, does not differentiate between historical and philosophical knowledge; historical thinking and consciousness; philosophical reflection; and a series of more generic pointers towards the overall quality and coherence of the work. For each of the criteria there are suggested descriptions of typical work at just three levels across the 6 marks available.

People's Republic of China – *Gāokǎo* (National Higher Education Entrance Examination)

The *Gāokǎo* is designed to select students for study at universities in the People's Republic of China and other higher education institutions. The *Gāokǎo* is taken by students after they have successfully completed senior secondary education. History is a compulsory section within the *Gāokǎo* examination. The subject has four stated learning objectives and standards: acquiring and interpreting, transferring and using knowledge, describing and explaining events, and debating and discussing issues.

The content is organised into two parts. The first is compulsory and carries 84 per cent of the examination marks whilst the second is elective and carries 16 per cent of the marks. The syllabus covers Chinese and non-Chinese history at different points through time. As such it is designed to be a study in breadth, at points also covering different countries and concepts in depth. There is a very broad chronological range of topics in this syllabus. The compulsory content ranges from ancient, through modern, to contemporary history. Within this there is a constant theme running through – that of a study of Chinese history within a given period, and a study of "the world" within the same period. The content of the Chinese topics appears to be in a little more depth than the international ones, a key example being the ancient topic. The inclusion of world history also provides a useful international context to the study of Chinese history.

In terms of the type of history studied in this course there is a strong emphasis upon political history, with some economic and cultural history. It is tightly focused upon political systems and philosophies, including constitutional monarchies, republics, reform and revolution, democracy and communism. An element of judgement is implicit within some topics of national history, for example "Crimes of the Japanese military invasion of China" and "China's resumption of its legitimate seat at the United Nations". There is a little more variety in the optional content, with the inclusion of options such as the study of world cultural heritage sites and collections and Chinese and foreign historical figures, but even here there is an obvious slant towards political history, for example the chosen key figures include Washington, Napoleon, Marx,

and Mao Zedong. There are a large number of topics to cover in this syllabus but the examination process requires detailed knowledge rather than any real depth of understanding.

The final assessment for this course consists of two papers which are externally assessed. Students have just 90 minutes to complete both, to answer 25 multiple-choice questions on the compulsory content and a further three written questions (one on the compulsory content, and students choose two out of six on their optional content), many of which are themselves split into two sub-questions.

The demand of the multiple-choice paper is created more by the requirement on students to cover a huge range of content than by the tasks themselves. They test the correct recall of events and definitions and so do not require the application of information or reasoning about such concepts as cause and consequence. In some instances the inclusion of source material will force students to think, and apply prior knowledge, to select the correct answer.

In Paper II the questions asked follow a set pattern of stems and demands, requiring students to “summarise” and “explain”, to comprehend material in the sources and to place this within a context. In isolation, these terms appear undemanding for students at this level and do not allow higher-achieving students to demonstrate what they can do. However, in some cases the issues they target, such as “how the humanists, artists and 18th-century scholars of the Renaissance period handled the issue of religion”, are quite complex and demanding. However, summarising and explaining do not appear to allow students to demonstrate skills such as analysing, assessing, reaching judgements, testing interpretations and other higher-order skills. The limited marks and time available suggest there is little scope for exploring alternative interpretations and that essentially students are required to present short summaries of received information.

Republic of Ireland – Leaving Certificate (Established)

The Leaving Certificate (Established) is designed to be studied by the full range of students in the senior cycle (upper secondary), rather than only those planning to continue their studies at university. History is an optional subject and can be taught at both Ordinary and Higher levels, differentiated through the specification of learning outcomes. Taking higher level history within the Leaving Certificate uses about 20 per cent of Leaving Certificate course time because a student typically studies five subjects. In England a typical student takes three A levels using about 30 per cent of course time per subject.

The learning outcomes are broken down into two parts. Part 1 focuses on working with evidence which includes understanding the role of evidence; identifying and interpreting a range of sources and questioning provenance, purpose and usefulness; drawing conclusions from sources to form judgements; identifying

strengths and limitations of sources and recognising the provisional nature of history. Students are also required to undertake a piece of research. Part 2 is concerned with knowledge and understanding, requiring students to recall main events, show good understanding of cause and consequences, and recall issues and events in the three case studies: they must give discursive accounts of these; evaluate the role of key individuals, and show understanding of the relevance of key concepts to the topic in question.

Half of the course is devoted to Irish history, plus a requirement to see how the Irish topics fit within the wider world topics. There is a wide chronological spread of topics from which a teacher chooses what their students will study. On both the early modern and later modern options, the rest of the world is studied only in the context of empires and colonialism, with the exception of an opportunity to study the modern USA. There is a strong emphasis upon political history (reflected in the examination papers), but there is also social, economic and cultural history. The approach is a chronological narrative with little reference in the content to challenging the accepted narrative.

It is possible for schools to construct a relatively short period of study. For example in the later modern period, they will complete the document study on Ireland: Topic 5 politics and society in Northern Ireland 1949–93, and three others which could be: Topic 6 government, economy and society in the Republic of Ireland, 1949–89; plus from the European and world list: division and realignment in Europe, 1945–92 and the United States and the world, 1945–89. It would also be possible for students to undertake their personal research study from the same area of history as this is a matter of individual choice, with teacher guidance.

The structure of the syllabus means that, in effect, the prescribed topic for the documents-based study (which changes each year) is the core, with a free, if limited, choice from the other topics within that field of study. The syllabus maintains a balance between Irish and European history by ensuring that two topics are chosen from each.

The final assessment for this course is an examination of two hours 50 minutes' duration. There is also a personal research study carrying 20 per cent of the final assessment weighting. The examination paper is divided into three sections. Section 1 tests the nominated source-based option. It contains two sources and three sub-questions requiring comprehension, comparison and criticism of the sources. A fourth question is a short essay on the same topic as the sources. However, there is no requirement to integrate the sources with the student's own knowledge in order to make a judgement. This lessens the demand.

Section 2 has five sections, each with four essay questions from which students choose one. Section 3 also has five sections, each with four essay questions from

which students must choose two, both of which must come from a separate topic. Some invite descriptive narrative, others invite explanation while others appear more demanding, requiring analysis and comparative judgements. Despite these variations all are weighted equally.

The mark schemes for essays are expressed in very generic terms regarding the writing qualities displayed such as structure, organisation and support. There is no reference to indicative content or specific questions beyond occasional very brief comment. The schemes use the interesting feature of cumulative marking (CM) and overall evaluation (OE) in a ratio of 60:40. The effect of this, however, appears to allow students to accumulate maximum marks for CM for lengthy responses which lack penetrating analysis.

Republic of Korea *Su-neung* (College Scholastic Ability Test, or CSAT)

The Republic of Korea College Scholastic Ability Test (CSAT) is designed to select students for study at South Korea's universities and other higher education institutions. History forms part of a social studies course. The history component uses the language of historical consciousness to express its aims to provide an understanding of the roots of issues in the present which will help students understand the prospects of future developments.

The content of this assessment has a strong emphasis on Korean history for those who choose history as part of the social studies curriculum. All history units are options. In the 11th Grade students choose four from 11 subjects three of which are Korean history, Korean modern and contemporary history and world history. Whichever they choose they have to cover everything, meaning that the course covers over 1,000 years, from ancient civilisations to the modern day. There is a heavy emphasis on content coverage. Of the three options, Korean modern and contemporary history had most entries in 2010, at 236,487 entries, followed by Korean history at 63,838 entries and lastly world history which had 42,428 entries.

There is a clear emphasis upon developing a sense of identity and developing the skills of analysing data critically and problem-solving. It is also the only assessment to claim that its make-up and structure are the result of student requests.

The Korean history element covers a broad range of themes, so students will know about political, economic, social and cultural history. The vast range of topics and the structure of the examination show that detailed knowledge is tested rather than students' depth of historical knowledge and understanding.

From the sheer number of compulsory topics and the nature of the final examination paper it would appear that students need to acquire a substantial amount of knowledge. All topics are compulsory and there is no prior indication of which topics or themes will be targeted in the final examination paper. Each of the history options

is examined in a single paper with 20 multiple-choice questions testing factual knowledge across all topics.

The questions do not discriminate in demand and the only difference between questions worth 2 and 3 marks is that for the 3-mark questions the student must correctly choose the right combination of two out of the five possible correct answers.

United States of America – New York State Regents Diploma

The Regents Diploma in New York State is designed to be studied by the full range of students, rather than only those planning to continue their studies at university. Two subjects are available as part of the Regents examinations that contain historical content: Global History and Geography and US Government and History. Both are compulsory requirements as part of the Regents Diploma. This study only considered US Government and History, as its examination is usually taken a year later than the examination for Global History and Geography. However, it should be noted that this is still earlier in senior secondary education than many of the examinations considered as part of this review. It should also be noted that we have only focused on one of the compulsory history-related courses for this qualification.

Taking history within the diploma uses about 5 per cent of Regents Diploma course time. The history of the United States and New York course and the world history course together deliver delivers two of the 22 credits students are expected to gain through their study within the high school programme. In England a typical student takes three A levels using about 30 per cent of course time per subject.

History forms part of a social studies curriculum and in the senior secondary years is underpinned by prior study of the Grade 7–8 social studies programme: United States and New York State history. The goal of the K-11 social studies core curriculum overall is for students to:

> learn the structure and function of governments and to learn how to take on their roles as citizens. Students should understand those basic principles and the cultural heritage that support our democracy so that they can become informed, committed participants in our democracy. This core curriculum lists examples that describe how individuals and groups throughout history have challenged and influenced public policy and constitutional change. These examples and this course of study should help students understand how ordinary citizens and groups of people interacted with lawmakers and policy-makers and made a difference.
>
> (Regents Diploma assessment materials)

Expectations for students are framed in terms of learning standards. These include performance indicators and evidence of success descriptions. There are three levels of standards. The highest level is Commencement. They are broad statements, for example: “requires an analysis of the development of American culture, its diversity

and multicultural contexts and the ways people are unified by many values, practices and traditions". Students are expected to describe and analyse "important ideas, social and cultural values, beliefs and traditions and illustrate the connections and interactions of people and events across time and from a variety of perspectives" (Regents Diploma assessment materials). Skills include explaining the significance of historical evidence, weighing up importance, reliability and validity of evidence; the concept of multiple causation, and changing and competing interpretations. On the examination paper itself the questions relating to sources were based more heavily upon source comprehension than on the interpretation and analysis of those historical sources.

As the title of this examination indicates, the topics concentrate on the history and government of the USA, with an emphasis on political history; although there is coverage of social and economic affairs. These topics offer a depth of coverage. Topics cover the span of USA history and also address other parts of the world through consideration of US foreign policy. Alongside the content of the topics a number of concepts and themes are emphasised throughout the curriculum such as: change, citizenship, civic values, constitutional principles, culture, and intellectual life, amongst others.

Students need to acquire a substantial amount of knowledge as part of this course. All topics are compulsory and there is no prior indication of which topics or themes will be targeted in the final examination paper.

The final assessment for this course is one three-hour paper taken at the end of the course. It consists of three parts. Part I is comprised of 50 multiple-choice questions each worth 1 mark. For each question, students must choose one response from a range of four possible answers. This section covers the entirety of the course content.

Part II is a single compulsory essay question. It takes a theme from the course content and students have to illustrate it and discuss it using two examples.

Part IIIA consists of nine documents with 14 short-answer questions. In all cases these test comprehension – asking students to read the source and answer a question about its content.

Part IIIB is an extended writing question which requires students to integrate their own knowledge and selected pertinent information from the sources in Part IIIA into a structured extended piece of writing on two topics from a choice of three.

The questions in part I do not require higher-order analytical skills to answer, but they do expect students to have a substantial amount of knowledge on which to draw. The questions require consideration of themes, concepts and values, and the language used in the questions is quite sophisticated.

The extended writing parts (particularly part II) of the paper are considerably more demanding than part I, and these would offer more challenge for higher-attaining students.

In the document-based questions in part IIIA, the students are required to comprehend the sources, but do not get the opportunity to demonstrate their further higher-level skills. The final part IIIB requires students to use the sources as well as their own knowledge which is a more demanding skill.

The scaffolding (or directions given to candidates) used within questions is quite extensive. It is found on both of the extended writing questions and includes guidelines to students on how to approach and structure the answer, as well as definitions of the terminology used in the questions. For example, “discuss” is defined in part II. This is useful for lower-attaining students but it may not allow higher-performing students to demonstrate critical analysis as part of their response.

The New York State Regents Diploma study of history offers a considerably different model from that offered by the A level. In terms of content, it concentrates on the acquisition of a considerable body of knowledge, and the assessment styles used are suitable to test a student’s grasp of this knowledge. And as the two courses including history are requirements in completing senior secondary education, and are usually assessed before the final year of education, they serve their purpose well. However, the assessments would not allow students to demonstrate higher-order analytical skills.

University of Cambridge International Examinations AS levels and A levels

The Cambridge International A level qualifications are designed primarily for students who intend to continue their studies at university. History is a subject choice within the Cambridge International A level. It is made up of two sections: the AS, usually undertaken in the first year, and the A2 in the second year, which, when combined, make a complete A level. As with the A level in England, a typical student takes three A levels using about 30 per cent of their course time per subject.

The syllabus offers a choice of two from six periods which are modern European history 1789–1939; South-East Asia: from colonies to nations 1870–1980; international history 1945–91; the history of tropical Africa, 1855–1914; the history of the USA, c.1840–1968; and Caribbean history, 1794–1900.

There are five assessment objectives. Four are tested by essay questions. These are to:

- demonstrate an understanding of the complexity of issues and themes within a historical period

- distinguish and assess different approaches to, interpretations of, and opinions about the past
- express awareness of historical concepts such as change and continuity, cause and effect in the past
- present a clear, concise, logical and relevant argument
- evaluate and interpret source materials as historical evidence and demonstrate facility in their use; this is mostly tested in source-based questions.

(Cambridge International A level assessment materials)

This course is designed to be suitable for students from different parts of the world. The content and context offered for teachers to choose from covers most continents to a greater or lesser extent, apart from Australasia and South America. Within each paper the topics follow a themed approach (except for tropical Africa), with a very in-depth examination of the history of several nations. For example Paper 1 (further described below) requires a study of the French revolution, the industrial revolution, the Russian revolution and totalitarianism between the wars, amongst other things.

The course is assessed in two equal parts, the AS and the A2, each of which carries 50 per cent of the total assessment to complete the A level. There are six different three-hour examinations (referred to as papers) and students choose one paper to complete the AS level, and two to complete the whole A level. Students can undertake their examinations in two different windows each year (June and November), but not all papers are available in each window.

On each of the Papers 1, 2, 3, 5 and 6 there is one source question, which is testing an interpretation, and a choice of three from seven essay questions. All questions carry equal weighting. The course content is satisfactorily covered, with a thematic approach. Paper 4 on the history of tropical Africa is treated slightly differently. On this there is a choice of four from ten essay questions, all of which carry equal weighting, and there is no source question.

Overall the questions on these papers are demanding. There are few common stems and approaches, and tasks require students to “discuss” and “examine”. This deliberately open nature allows higher-attaining students to fully demonstrate their knowledge and skills, but provides little help for the lower-attaining student to formulate a response. There is very little predictability to these questions, although some are more straightforward than others. Mostly, the questions require students to “examine” or “discuss” in order to remain very open, enabling students to form an individual structure and response to the question. However, some questions are phrased as “why” questions, and these would not offer the same level of challenge.

In terms of demand of the overall qualification, the structure, where students complete one paper to achieve an AS and two to achieve the A level, makes it

difficult to identify progression in the assessments between the first and the second year. Students knowing that they will be examined in two topics (although they are broad in themselves) may restrict the content students gain as part of the course, depending on how it is taught. Overall, the style of the assessments would enable students to demonstrate their full range of skills.

University of Cambridge International Examinations Pre-U Diploma

The Cambridge Pre-U is designed for students who intend to continue their studies at university. History is an optional subject as part of the Cambridge Pre-U. Taking history within the diploma uses about 25 per cent of Pre-U course time, because a student studies global perspectives and research in addition to their three chosen subjects. In England a typical student takes three A levels using about 30 per cent of course time per subject.

Its stated aim is to stimulate interest in, and to promote the study of, history; and to give students the opportunity to develop an understanding of the complexity of human societies; to identify patterns in, and connections between, apparently contrasting events and developments; to develop their skills of interpreting and evaluating evidence; and to use independent study skills, to read widely, write fluently, and to develop the capacity to formulate and justify their own ideas about the past. This syllabus is intended to give freedom to choose aspects of historical study, but also to ensure that all students are introduced to advanced study in a coherent way and are given an opportunity to put their study into a wider historical context. It also gives students the ability to undertake independent and self-directed learning, and to think laterally, critically and creatively.

The four explicitly stated assessment objectives are:

- recall, select and deploy historical knowledge accurately
- investigate historical questions and present explanations, showing understanding of appropriate concepts, and arriving at substantiated judgements, using historical documents where appropriate
- explain, interpret and evaluate source material and interpretations of the historical events studied
- organise and present historical information with a balanced, coherent structure, communicating historical knowledge and understanding clearly and persuasively, using appropriate terminology.

(Cambridge Pre-U materials)

Across the syllabus there is a wide range of topics in terms of both chronology and content on British and European history. There is also a range of topics on US, African and Asian limited to the more modern period. There are also many different types of history to study, from the significance of individuals to the causes and origins

of civil war, to monarchy and revolution. This should allow a study of entirely different events, periods and types of history or a theme based on one of these. In the qualification as a whole there is a high degree of choice regarding options, both when selecting which routes to take and papers to study, as well as selection of questions on the papers themselves.

The qualification has four parts, all of which are examined at the end of the course. Each part constitutes 25 per cent of the total assessment. In the examination for the first part, students pick two papers (called outline papers) out of a choice of eight (available are three on British history, three on European history, one on US history and one on African and Asian history). They may not select more than one on Britain or Europe but equally they do not have to study either. In these there is extensive choice. There are up to ten different sections on the paper with varying numbers of questions, from 52 on European history outlines c.1378–c.1815, to 38 questions on US history outlines. Students may answer any three questions but they must be selected from at least two different sections of the paper.

On each outline paper students must answer three essay questions from at least two sections of the paper. Most papers have nine sections with five questions in each but the thematic sections always have six questions. All questions carry the same number of marks and weighting, and all use the same mark scheme. However the style, nature and approach of the questions is not formulaic. Content coverage is good given the number of questions on each section. It is not predictable that a certain topic will arise but the course supporting materials do state that all topics will appear over two years. It appears that the essay questions across the papers assess the same historical concepts and processes, albeit in a different historical context.

The second unit, the special subject, is also assessed by an examination which includes both source-based and essay questions. With the exception of the Crusades 1095–1192, the special subjects cover 20–50 years and therefore provide in-depth study. On the special subject papers, students must answer one compulsory source question, split into two parts, and one essay question from a choice of three.

Finally, for the personal investigation students must write one extended essay (3,500–4,000 words) on a topic of their choice (there are some restrictions on choice to ensure breadth of coverage).

8 Cross-cutting themes and issues identified

In bringing together the four sets of subject findings a number of themes emerged which encompass the differences between the main senior secondary qualifications used by students to support progression to university in England and in other high-performing countries. By presenting these emerging themes as issues we can suggest a framework for discussing how A levels available in England compare with the qualifications offered at a similar level elsewhere in the world.

The issues for consideration are:

Issue 1: Breadth versus depth – Many systems have a baccalaureate- or diploma-style assessment system including the study of a number of subject areas that are not required as part of A levels. Would this additional breadth outweigh the strengths of additional depth of the current A level system?

Issue 2: Independent study – Would the inclusion of independent research, projects and extended essays bring additional depth to subject expertise?

Issue 3: Different levels of demand within mathematics – The number of different mathematics assessments at a variety of levels available to students in many education systems was also in contrast to A level Mathematics. Is there a need for A level Mathematics to have further lower-level options in addition to AS?

Issue 4: Breadth versus depth within mathematics – Within the more challenging mathematics courses considered, A level Mathematics is unusual in covering both pure mathematics and the application of mathematics in the same course. While this means that more fields within mathematics are available to study, other education systems include more demanding mathematics which an A level student can only access through additional A level courses. Would a more focused A level mathematics course better serve the needs of more capable mathematicians?

Issue 5: Specialism within mathematics - A level Mathematics includes optional routes. This means students with the same grade in the qualification may not be equally well prepared for a specific further course of study. Would distinct qualifications, building on a mathematical core but emphasising the different specialisms, better serve students and those seeking to match them to appropriate further opportunities?

Issue 6: Mathematical content in chemistry – A strength of A level Chemistry was seen to be its high mathematical content in comparison with other systems. Is this balance correct? Would students and higher educationalists find it preferable to have further or deeper chemistry

content within chemistry and move the bulk of mathematics currently covered in chemistry to mathematics subjects?

Issue 7: Focus of the study of English − A levels were found to be distinctly different from the study of English in other education systems as they have an exclusive focus on reading and interpreting traditional forms of text. In other systems there is a broad range of views on what could be considered a text (from a photograph, to film, to Chaucer). Would a broader approach prepare students better for studying in a higher education setting?

Issue 8: Purpose behind studying history − Other systems often had a clear rationale for the study of history at senior secondary level, for example to promote good citizenship. Do we need to address a purpose for the study of A level History beyond preparing students for higher-level historical study?

Issue 9: School-based assessment – Should there be more teacher- and school-based assessment with the potential to stretch students, especially where oral examinations are part of the system?

Issue 10: Multiple choice – Multiple-choice questions are common in other education systems at senior secondary level. They are not common in A levels. Multiple-choice questions can be used to test large amounts of content and assess skills such as the ability to use the English language. These can be difficult to test by other means. Should we revisit the use of multiple-choice questions in A level assessments?

None of these issues are new to the ongoing discourse about English A levels. Each issue has been considered and debated during the development of the English national qualification. However the current round of discussions can now be informed with key evidence from a wide range of individual countries' approaches and experience.

Issue 1: Breadth versus depth

Many systems have a baccalaureate- or diploma-style assessment system including the study of a number of subject areas that are not required as part of A levels. Would this additional breadth outweigh the strengths of additional depth of the current A level system?

Evidence from this study shows the structure of A levels to be very unusual when compared with the qualifications available to students at senior secondary level worldwide. Almost all of the education systems studied favour a baccalaureate- or diploma-style qualification, with a core of compulsory subjects supplemented by a range of optional specialisms. Even some university entrance examinations are delivered in a diploma style. In the People's Republic of China the *Gāokǎo* has three core areas, whilst the ACT is made up of four content areas.

The number of subjects studied at senior secondary level elsewhere in the world is considerably higher than in England – a minimum of 13 in the Denmark STX at the top end of this. In many education systems, students are generally required to study a social science, science, mathematics, a foreign language and a home language subject at the very least until age 18.

On top of these core subjects, most qualifications and assessments either allow, or more usually, insist upon some elective content allowing a student to specialise in a certain discipline or path. In the HKDSE, for example, students are expected to take four core subjects (Chinese language, English language, mathematics and liberal studies), as well as two or three elective subjects selected from a bank of some 30 options, including vocational study.

In some education systems, the elective subjects available are determined by the strand of the qualification that students have selected. In France, a *baccalauréat général* student can follow either the *série scientifique* (S), *série économique et sociale* (ES) or *série littéraire* (L) – sciences, economics and social sciences, or literature respectively. Within each, students study between nine subjects (if they select a compulsory subject as their speciality) and 12 subjects leading to national external examinations.

Qualifications which are offered on a subject-by-subject basis are far fewer in number. These include A levels, Cambridge International A levels, Cambridge Pre-U certificates and the HKALE.

Given that an A level student typically studies far fewer subjects than their international counterparts, it is perhaps not unexpected that the depth and breadth of content in A levels is amongst the most demanding seen in this study. Each A level subject is likely to account for between a quarter and a third of the total senior secondary course time, far higher than the time allocated to equivalent subjects in

some of the baccalaureate qualifications. As such, A levels contain a considerable breadth of content compared to most of the other qualifications in the study, and are able to explore much of this in some depth due to the space in total curriculum time devoted to the subjects.

If we take chemistry as an example, we find that stand-alone qualifications such as the OCR A level, the HKALE and CIE qualifications come out very strongly in this review. The content of OCR A level is broader and deeper than the majority of other specifications.

In other education systems depth is also achieved through the study of optional material. In Denmark teachers and students are expected to supplement the compulsory content by choosing topics to study more deeply or in different contexts. Most of the other courses offer a choice from a number of optional topics.

Issue 2: Independent study

Would the inclusion of independent research, projects and extended essays bring additional depth to subject expertise?

This study found that some of the most demanding elements of qualifications worldwide included independent projects and sustained study tasks.

A number of the qualifications in the study include an independent study project, often in the form of a piece of research or an extended essay. These elements can help to build the skills of deep thought, synthesis, research and self-directed learning which are so highly prized by universities. They can also introduce additional depth into subject study or help to build links across separate subjects. The format of these independent research tasks in different education systems often depends on the structure of the qualification. In diploma- or baccalaureate-style qualifications, these projects sometimes form a separate study area designed to stand alone from, or cut across, the subjects being studied (France *baccalauréat général*, IB Diploma). In other education systems, projects may be contained within the syllabus for specific subjects (New Zealand NCEA Level 3).

In France, students studying for any stream of the *baccalauréat général* are required to produce their *travaux personnels encadrés* (TPE), an independent project which crosses over two or more subjects (Eduscol, 2011). This is undertaken in small groups. Students also carry out independent study as part of the IB Diploma, completing an extended essay enabling them to engage in their own research through an in-depth study of a question relating to one of the subjects they are studying. In both qualifications, these projects are distinct elements of the assessment, standing apart from the study of subject areas.

Independent study projects are also used within subject syllabuses to provide depth of study in an area, and to build and assess subject-specific skills. In chemistry in particular, all qualifications emphasise the importance of practical work as an essential ingredient of chemistry at senior secondary level. The extent to which this is reflected in extended practical investigation varies, however.

An alternative approach is the IB Diploma which emphasises the importance of practical chemistry as an investigation. In the IB Diploma practical work is assessed by conducting a series of investigations together with a project using generic criteria. This requires higher-order skills to design, conclude and evaluate findings. Candidates are expected to complete 60 hours of practical activities and project work which contributes 24 per cent of the final score. A similar approach is taken within the New Zealand NCEA Level 3 chemistry course. Students studying the internally-assessed units undertake an open-ended investigation. Within this they design and carry out their own experiments in support of a research project, capturing the results

in a report. This was seen as being a demanding aspect of the course and one which would develop valuable skills for future study.

Independent study also adds demand in other subject areas. In history the inclusion of independent study supports the development of historical interpretation and enquiry; core components of the majority of history courses included in this study. In the assessment of historical enquiry, some qualifications or assessments contain a compulsory component of historical enquiry personal research. These include the A level, the Cambridge Pre-U, the Hong Kong HKDSE, the IB Diploma, the New Zealand NCEA Level 3, the Republic of Ireland Leaving Certificate (Established) and in the preliminary school-devised part of the New South Wales HSC. In all of these qualifications, independent study is a valuable way of increasing depth of knowledge, alongside developing subject-specific and more general study skills.

There is a similarity between the New Zealand NCEA Level 3 historical research internal assessment task, the IB Diploma historical investigation and the Edexcel A level historical enquiry. However it is interesting to note that the New Zealand NCEA Level 3 course has a much more flexible approach to the format in which the task can be presented; for example, designing a museum display for a battle or campaign in the Second World War, or a historical walking tour. The New Zealand NCEA Level 3 course is also unusual in its emphasis on the pre-teaching of research techniques in order to prepare students to undertake the internally-assessed task.

Where education systems incorporate independent research and study projects in subject syllabuses, this tends to be a feature of all disciplines, rather than being limited to particular subjects. In the Hong Kong HKDSE, for example, school-based assessment (SBA) is a component of every subject from mathematics to English. This requires students to complete a self-directed independent research project, sometimes over a number of school terms.

Even in those education systems where there is not an assessed research project, independent study skills are emphasised in other ways. At the start of the three-year STX in Denmark, students follow a six-month foundation programme during which they learn general study skills. Throughout the rest of the course, they are expected to study independently for 25 per cent of the course time, allowing them to pursue their own studies to greater depth. It is also usual practice in Danish schools for students to have access to reference materials during their examinations, including access to the internet. In addition to testing subject knowledge the assessments are also intended to test research abilities, data handling and analytical skills (Ministry of Children and Education 2012g).

Issue 3: Different levels of demand within mathematics

The number of different mathematics assessments at a variety of levels available to students in many education systems was also in contrast to A level Mathematics. Is there a need for A level Mathematics to have further lower-level options in addition to AS?

In England there is a huge range of A level subjects which students can study including A level Mathematics and Further Mathematics. However mathematics is not compulsory post-16. Lower-level mathematics qualifications are available in England, but they do not generally make up part of what a student does alongside their A level qualifications. Students who complete GCSE Mathematics have no clear course of study to expand their knowledge and understanding of mathematics, other than the AS and A level Mathematics courses.

A level Mathematics is unusual in that it offers six different routes of study. By choosing a different combination of applied units a student can tailor their course towards their chosen career path or higher education course. However, all of these routes through the qualification are designed to be comparable and therefore no one route would be more suitable for lower-ability candidates. Additionally, all routes require completion of the pure mathematics core units rather than allowing students to pursue an application-based course of study. There is, however, a separate A level in Pure Mathematics.

Many of the education systems in this study offer qualifications at a range of levels. This is particularly important where qualifications are intended to be taken by the full range of students at senior secondary level. Mathematics is one of the subjects with the greatest choice of levels of study available, with three or four programmes of learning often available to students. In the qualifications and assessments in which mathematics is compulsory post-16, often it is the ability of the student that determines which of the routes they will follow.

The highest number of options for mathematical study is available in the IB Diploma. Within this qualification students must complete one subject within the mathematics and computer science group. Within the mathematics group there are four individual subject choices. Two of these are at standard level, Mathematics and Mathematical Studies, and two at higher level, Higher Level Mathematics and Further Mathematics. The higher-level qualifications were deemed to be amongst the most demanding in this study. The standard level is pitched at those students who will need a sound mathematical background as they prepare for future studies in subjects such as chemistry, economics, psychology and business studies. The demand was judged to be below A level.

More common is an offer of three different mathematics courses, pitched at three different levels. In the Republic of Ireland, there are also three levels of study

available for mathematics: Foundation, Ordinary and Higher. This is in contrast to the majority of other subjects in the Established Leaving Certificate which are only available at two levels. Foundation mathematics is geared towards vocational and functional mathematics. Ordinary mathematics is essentially a service subject, providing knowledge and techniques that will be needed in the future for the study of scientific, economic, business and technology subjects. Higher mathematics is the closest equivalent to A level and is the study of predominantly pure mathematics as a discipline.

Likewise, the Denmark STX is designed to be studied by students intending to continue their academic studies at university. Mathematics is a compulsory part of the STX programme and may be taken at three different levels: A, B and C. For preparation for higher education in a STEM (science, technology, engineering, mathematics) related subject or a subject that requires any form of statistical analysis it is necessary to study the STX level A in mathematics. This programme requires 325 guided learning hours which is roughly equivalent to A level.

In some other education systems, mathematics is offered at two levels: a basic compulsory level and a more demanding optional level. The incoming HKDSE, for example, is designed to be taken by all students. Mathematics is part of the HKDSE and comprises of a compulsory part and an extended part. All candidates must follow the compulsory part of the syllabus.

In other education systems, the nature and level of the mathematics qualification studied is dependent on the stream of learning in which a student is enrolled. In France the baccalauréat général is made up of three streams. At one end of the scale is the literature stream of which mathematics is a minor part. The syllabus for mathematics in this stream is heavily focused on basic algebra, statistics, arithmetic and geometry, and was judged to be significantly below the standard of A level.

Issue 4: Breadth versus depth within mathematics

Within the more challenging mathematics courses considered, A level Mathematics is unusual in covering both pure mathematics and the application of mathematics in the same course. While this means that more fields within mathematics are available to study, other education systems include more demanding mathematics which an A level student can only access through additional A level courses. Would a more focused A level mathematics course better serve the needs of more capable mathematicians?

The majority of the qualifications and assessments in mathematics included in this study emphasise either pure or applied mathematics. The in-depth study of both aspects of mathematics within the same course is unusual, and rarely seen outside the A level. The balance between breadth of application and pursuit of complex and deep study is a tension inherent in the study of a discipline and was a major consideration when comparing the demands of different mathematics qualifications included in this study. Many qualifications and assessments in the study emphasise one over the other, and it is apparent that either emphasis may result in a demanding qualification.

The depth to which a topic is studied is particularly significant in the judgement of demand. Depth of study more than numbers of topics was judged to be more important in raising the demand of the specification. For example the ACT tests complex numbers but only superficially and this in itself is not enough to raise demand, whereas the in-depth knowledge required by A level Further Mathematics and the IB Diploma significantly raises the demand of those specifications.

Within the A level system there is the option for students to study in depth by taking Further Mathematics and 15 per cent of students who study A level Mathematics take this up. Similarly the Hong Kong HKALE, IB Diploma and New South Wales HSC also have options within which students can increase their level of study.

A number of qualifications in the study are structured to focus on a narrow range of topics, often to much greater depth than is possible at A level. These qualifications and assessments include the Hong Kong HKALE, the Netherlands vwo, the People's Republic of China *Gāokǎo* and the Republic of Korea CSAT. These four systems all required the study of abstract and technically difficult mathematics which raised qualification demand. In all cases, their assessments included some questions that were more demanding than those found in A levels. This was also true of selected questions contained within the assessments for NSW HSC (Mathematics with Extension 1 or 2), the science series of the France *baccalauréat général,* IB Diploma (Higher level), New Zealand NCEA, People's Republic of China *Gāokǎo* and the Cambridge Pre-U.

Other qualifications and assessments provided a much broader approach to the discipline of mathematics. A level Further Mathematics was the broadest and the deepest qualification reviewed. It is unusual in that the study of three application disciplines, statistics, decision mathematics and mechanics, is offered. The next broadest qualification was A level Mathematics, with two applications, statistics and mechanics, being most commonly studied. While some other qualifications come close, such as the Higher Level IB Diploma by requiring a significant amount of statistics and probability, only the Cambridge International A level, the Cambridge Pre-U and to some extent the New South Wales HSC require the study of a significant amount of applied mathematics.

Whilst demand was strongly associated with depth, there was also a link to breadth. Where the study of certain topics (such as calculus and trigonometry) was not included in a qualification or assessment to some significant level, this was deemed to lessen demand. In addition, the ability to adapt one's approach and mind-set to different applications of mathematics across a broad qualification may have the potential to raise the demand of the qualification, and allows students more flexibility in the pathways they can follow in higher education.

Issue 5: Specialism within mathematics

A level Mathematics includes optional routes. This means students with the same grade in the qualification may not be equally well prepared for a specific further course of study. Would distinct qualifications, building on a mathematical core but emphasising the different specialisms, better serve students and those seeking to match them to appropriate further opportunities?

As noted in Issue 4 there is an emphasis in most qualifications on the study of either pure or applied mathematics. The study of both aspects of mathematics within the same course is unusual, and rarely seen outside the A level.

In some education systems the emphasis on pure or applied mathematics is dictated by the level of the course studied. As part of the Finland Matriculation Examination, the basic level mathematics syllabus covers a range of topics in mathematics and its applications. The advanced level covers a similar range of topics to the core modules C1–C4 (Pure Mathematics) of the A level and there are no significant application topics.

The Edexcel A level qualification is made up of the four pure mathematics core units C1–C4 plus two applied units. There is a choice of two applied units from the six available: Decision Mathematics D1 and D2, Mechanics M1 and M2, and Statistics S1 and S2. D2, M2 and S2 may only be studied in the second year as a follow-on to their partner unit. The most popular combination is C1–C4 plus M1 and S1.

The Further Mathematics qualification is designed to be taken alongside A level Mathematics. About fifteen per cent of A level mathematics students study this combination. In order to achieve A level Further Mathematics students need to complete a further six modules of study beyond those studied for A level Mathematics. The core is Further Pure 1 and either Further Pure 2 or 3 with another four modules being selected from ten potential pure and applied options. The most common option pattern is Further Pure 1, 2 and 3 and Mechanics 2, Statistics 2 and Decision 1. The choice of options for A level mathematics and further mathematics students will usually be restricted to the course combinations available at their school or college.

In other qualifications and assessments, separate pure and applied mathematics courses are available for students to choose between. In the Alberta Diploma, two different mathematics courses are available at each level of study. At the 30 level, students may study Pure Mathematics 30 and Applied Mathematics 30. The New Zealand NCEA also allows the study of mathematics in three different areas: Calculus, Calculus CAS and Statistics and Modelling.

Both Alberta and New Zealand actively encourage the use of new technologies as a feature of their assessments of mathematics. In the Alberta Diploma, graphical calculators play a key role in the learning of mathematics. In the New Zealand NCEA Calculus CAS course, there is a reliance on the use of algebraic calculators as a part of the course, ensuring that students gain experience in using technology they would use in higher education. Interestingly, in the Republic of Korea CSAT, there is also a heavy emphasis on the use of calculators and computers in the teaching of mathematics; however these are not allowed in the examination, thus restricting the topics that can be tested thoroughly.

The mathematics included in the A level and further mathematics combination above is amongst the most demanding in this study, similar to HKALE and the IB Diploma Higher. This study found that the mechanics papers allowed students to show they were able to apply pure mathematics to practical situations. In particular the Mechanics 2 module requires extensive problem-solving at this level. This would be very helpful for students whose choice of higher education takes them into science or engineering and technology degrees.

Issue 6: Mathematical content within chemistry

A strength of A level chemistry was seen to be its high mathematical content in comparison with other systems. Is this balance correct? Would students and higher educationalists find it preferable to have further or deeper chemistry content within chemistry and move the bulk of mathematics currently covered in chemistry to mathematics subjects?

The range and variety of chemistry that a student can study successfully is closely related to their mathematical competence. This can range from plotting experimental results on a graph to the formulation of algebraic equations used in rate calculations and chemical modelling. In all the qualifications or assessments included in this study, syllabuses appear to expect students to be able to carry out routine arithmetical calculations, such as those in stoichiometry and empirical formulae. However, the actual mathematical requirements are sometimes not defined within the course content.

One of the strengths identified of OCR A level Chemistry was the high mathematical content of the course. Qualifications with similarly high levels of mathematical content include the IB Diploma, Republic of Ireland Leaving Certificate (Established), the Cambridge International A levels and the Cambridge Pre-U. These all have a clearly stated mathematical component representing an integral part of the course. For the OCR A level and both the CIE syllabuses these are identical and the most demanding seen.

Of course, as previously noted, the A level is relatively unique in its structure compared with many of the international qualifications, comprised as it is of stand-alone subjects rather than an overall certificate. As it is possible that A level Chemistry students will not be studying mathematics alongside their chemistry course, there is perhaps more of a need to ensure that the required mathematical content is explicit within the chemistry syllabus.

This is in contrast to comparator education systems where mathematics is a mandatory subject for all students in most of the composite qualifications. However, this has a limited match with the demand for mathematics within chemistry assessments and mathematical requirements must be inferred from the topics covered and questions asked in written assessments. For example, the Denmark STX Chemistry A course specifically requires students to complete the STX Mathematics B course in support of their studies. It does not specify which mathematical knowledge and skills from that course students are expected to apply to chemistry; however, success in the assessments requires good mathematical skills.

An exception to this is the Alberta Diploma which clearly cross-refers the mathematical requirements of the chemistry course to the core mathematics syllabus.

In the Alberta Diploma, the Chemistry 30 syllabus cross-refers directly to specific objectives within their qualification's Applied and Pure Mathematics 10 and 20 syllabuses.

The impact of mathematics upon the demand of the assessment can be measured in terms of the proportion of the assessment which relies upon correct application of mathematical techniques and skills in support of chemical knowledge, understanding, application and skills in order to complete a task or questions. This is highest in the Denmark STX assessment at nearly half of the available marks, but unsurprising given the intensely investigative nature of the assessment. Lowest is the USA ACT which has no mathematical requirements in the science test, but does also test mathematics separately. The Regents Diploma is dependent on mathematics for less than 10 per cent of the assessment, but the remainder are grouped between 15 per cent and 30 per cent. This suggests a clear focus on chemistry, although it may also reflect the prevalence of short-answer questions rather than unstructured tasks.

Perhaps the lowest level of mathematical demand can be found in the New Zealand NCEA Level 3 qualification. This does not exceed the level of competence required for English GCSE Mathematics. The demand to be able to use, for example, logarithms in pH calculations is the same for the NCEA as for the Alberta Diploma and OCR A level, but there is a limited depth of use of mathematics in NCEA assessments. The remaining syllabuses rely much more on students learning the relevant material and being able to apply it in relatively simple cases. The difficulty of calculations tends to follow the same pattern as the range and depth of topics in the syllabus. Most composite qualifications present mathematically undemanding assessments. The exception is the IB Diploma with the wider range of content requiring more mathematics.

A variety of question types is used by the chemistry qualifications and assessments studied. These include multiple-choice and numerical response; short-answer questions; interpretation of data; calculations; evaluation and analysis; interpretation of data and use of graphs; and practical procedures, amongst others.

Issue 7: Focus of the study of English

A levels were found to be distinctly different from the study of English in other education systems as they have an exclusive focus on reading and interpreting traditional forms of text. In other systems there is a broad range of views on what could be considered a text (from a photograph, to film, to Chaucer). Would a broader approach prepare students better for studying in a higher education setting?

This study demonstrates clearly that there is no single, unified definition of English as an academic subject. Even within England there are three distinct A level qualifications: English Language, English Language and Literature, and English Literature. The A level chosen for inclusion in this study is the AQA English Literature B syllabus. However, not all of the countries included within the study which use English as the language of tuition have distinct English literature courses. The English courses available in comparator education systems may also include the study of language, and this may be one of the factors which promote the broader range of views on what might be considered a text in these qualifications.

It is clear that the qualifications included in this study have quite diverse aims. The AQA A level, the Cambridge Pre-U, the Cambridge International A levels and the IB Diploma concentrate on literature, the latter offering a more global perspective on the subject. These four qualifications are the most similar in terms of content as they focus on the more traditional forms of text. Others, such as the New South Wales HSC and New Zealand NCEA Level 3, and to a lesser extent the Alberta Diploma, New York Regents Diploma and the Republic of Ireland Leaving Certificate (Established), make the boundaries of English and English literature more porous, placing emphasis on the study of English to enable students to become good communicators, readers, thinkers and citizens.

Within these courses the definition of text and notions of canonicity vary considerably. Those qualifications which place some emphasis on the study of English for communication allow for the study of a wide range of text types (photographs, films, journalism, screenplays) not seen in the syllabuses that concentrate more exclusively on literature.

The portfolio requirement for both HKALE and HKDSE offers plenty of student choice and the opportunity to explore a range of writing styles, including film study. The New South Wales HSC features an inter-textual approach. The interdisciplinary nature of the specification (mixing traditional literary topics with media-based topics, for example), the emphasis on oral competency, and the opportunities offered for imaginative writing are distinct from other courses included in this study. Where more traditional literary texts are studied, these come from a wide range of periods and genres, and are expected to include classics, successful teaching texts and innovative recent works.

The New Zealand NCEA Level 3 syllabus offers a very good range of topics which are interesting and engaging for students; they are well balanced, with plenty of sub-topics available in the externally assessed standards. The study of English is opened up by the lack of division between language and literature together with the inclusion of the literary text and other forms of written and visual production. The oral component is an educationally beneficial part of the programme on offer.

In the Alberta Diploma, students may consider very diverse texts as part of their study. These may include modern drama (theatre, television, film, radio or screenplays), poetry and song, non-fiction and response to non-fiction.

Although A levels do prepare students well for continuing their studies at a UK university, this study found that the English Literature A level qualification may not provide specific preparation for all of the English-related degree courses available in England. This is because many English universities have developed broader English courses which look beyond the analysis and critique of literary texts to encompass the wider development and use of the English language. This is similar to some of the international qualifications in the study which manage to successfully blend the study of language and literature. The study of a more diverse base of texts is one feature of these qualifications.

Issue 8: Purpose behind studying history

Other systems often had a clear rationale for the study of history at senior secondary level, for example to promote good citizenship. Do we need to address a purpose for the study of A level History beyond preparing students for higher-level historical study?

This study found that in the majority of education systems included in this project, there was a clear vision for the study of history at senior secondary level. Qualifications place differing degrees of emphasis on: preparing students for higher study at university; developing students' critical thinking skills; developing citizenship; and developing students' interest in history. This rationale for the study of history impacts on the design of the qualification, particularly on historical content and the types of historical skills that are assessed.

Most of the qualifications or assessments view the study of history as a discipline as an important part of their rationale, but to varying degrees. The strongest statements are to be found in the Edexcel A level, the Cambridge International A levels and Cambridge Pre-U and the IB Diploma. The exceptions to this are the New York Regents Diploma and the Republic of Korea CSAT where history is placed within the context of a prescribed social studies programme. In two instances, the *baccalauréat général* in France and the *Vitnemål* in Norway, the discipline of history is seen as integrated with another discipline; geography and philosophy respectively.

For some of these qualifications or assessments the study of history is explicitly a preparation for study at university, namely the Edexcel A level, the Cambridge Pre-U, the Finland Matriculation Examination, the *baccalauréat général* in France, the IB Diploma, the Netherlands havo and vwo and the *Gāokǎo* in the People's Republic of China.

For others the skills and understanding derived from studying history are seen as a preparation for life and citizenship (whether national or global). In New York State the predominant emphasis is on "developing a disposition to democratic values and learning to function effectively in American society" (New York State Education Department curriculum materials).

Additionally, some place a special emphasis on students learning about the culture of their country, such as the *baccalauréat général* in France, the Matriculation Examination in Finland and the havo and vwo in the Netherlands.

This emphasis on national citizenship and understanding is clearly a factor in determining the extent to which students are required to study their own national history at one end of the spectrum and are expected to develop a wider continental or world view at the other. Related to this is the extent to which the qualifications or assessments offer choice to teachers on what content to teach. In some, such as the

baccalauréat général in France or the New York Regents Diploma, there is no choice of course content, but in others, most notably the A level, there is very wide choice.

Of the countries which do require students to study their own national history the weightings vary. In the Edexcel A level, students spend a minimum of 25 per cent on their national history as do students in the Matriculation Examination in Finland. The New York Regents Diploma is entirely focused on US history whilst that for the *Gāokǎo* places Chinese history firmly at the centre of its content. Of the rest, the Republic of Ireland Leaving Certificate course requires 50 per cent on Irish history, the *baccalauréat général* requires at least 50 per cent on French history, the Netherlands havo and vwo courses include one component dedicated to Dutch history, and the course from the NCEA in New Zealand can be studied entirely on topics from New Zealand history (although this depends on the optional topics chosen).

Only one qualification, the Edexcel A level, mentions the provisionality of history, although others describe historical interpretation as being open to debate. The New South Wales HSC specification describes history as a "contested dialogue between past and present" (Higher School Certificate assessment materials). Perhaps only in the New York Regents Diploma, the People's Republic of China *Gāokǎo* and the CSAT in the Republic of Korea does there appear to be a view of history as uncontested with a definitive narrative version.

Whilst these diverse senior secondary qualifications have very different purposes, these differences by themselves do not indicate different levels of demand. In some the content is more high profile, notably Finland's aims to teach students the principal "trends of Finnish and world history" (Finnish curriculum materials). In others, historical skills are also strongly emphasised. It is not possible to make a direct link between the relative status of content and skills in specifications and their level of demand due to the many other variables.

Issue 9: School-based assessment

Should there be more teacher- and school-based assessment with the potential to stretch students, especially where oral examinations are part of the system?

Within the assessment of senior secondary qualifications internationally, there is a strong emphasis on the use of internal assessment. In A levels there is a degree of school-based assessment for the subjects included in this study (with the exception of mathematics); however this is often less pronounced than in the other education systems in this study.

The emphasis on internal assessment varies considerably by education system or qualification. In the Alberta Diploma, Netherlands havo and vwo and New South Wales HSC, for example, the school-based assessment mark makes up 50 per cent of the final mark for the qualification. In the New York State Regents Diploma and the Republic of Ireland Leaving Certificate (Established), the qualification is fully externally assessed. However, most qualifications contain some elements of internal assessment, which combine with the results of external examinations to give an overall grade.

A minority of education systems promote the use of internal assessment over external examinations. In Norway's *Vitnemål*, a student's progress is assessed by teachers to provide the information for the overall achievement marks on the student's school leaving certificate. External examinations are required in up to five subjects, one of which must be home language. In all other subjects, a student is still assessed, but this is managed within the school and the results are reported centrally.

The design of the school-based assessment varies by system and the nature of the subject or skills being assessed. Across the qualifications studied, the internally-assessed tasks include a range of different approaches, with the potential to test numerous relevant skills in a demanding way. In New South Wales, for example, school-based assessments may include "tests, written or oral assignments, practical activities, fieldwork and projects" (Board of Studies NSW assessment materials).

It is of particular note that many systems use oral tests (both externally and internally) to assess subject knowledge and skills across all of the four subjects studied in this report (Denmark STX, Finland Matriculation Examination, IB Diploma, New Zealand NCEA, Norway *Vitnemål*). These oral examinations appear to be extremely demanding forms of assessment and an educationally beneficial part of the programme on offer.

In the Denmark STX history assessment, the 30-minute oral examination is based on 10–15 pages of very challenging pre-released material. These materials relate to one of the 15 stages of the curriculum covered and come in a variety of formats, including

tables of data, pictures and extracts of text. In the examination, the student must set out, analyse and discuss one or more of the issues connected with the topic that they are allocated. In the first ten minutes the student presents the historical problem(s) and their relationships with the completed curriculum stages. The examination then continues in the form of a 20-minute dialogue between the examiner and examinee. The flexibility and complexity of questioning that such an approach allows was considered very demanding. Having to demonstrate these skills would be valuable to a student looking to progress to higher education.

Another common style of internal assessment is a self-directed research project. In the New Zealand NCEA, practical research projects are built into a range of courses. In chemistry, students carry out open-ended investigation which allows students to design and carry out their own experiments in support of a research project. In history, internal assessment requires students first to plan and carry out independent historical research and then to communicate and present that research in context. These offer innovative ways of assessing students' understanding of the issues. Both of these examples were felt to be particularly demanding.

In the study of English, most education systems use internal assessment tasks as part of their overall assessment process. These include conventional essay-writing, creative and recreative[27] writing, and oral presentations. Where coursework is not included in a qualification (Republic of Ireland Established Leaving Certificate), this was felt to hamper students' opportunities for independent research. Coursework helps to develop independent thinking and decision-making and allows students to experiment with their own writing and responses to texts; it also caters well for all levels of the ability range.

In England, most of the A levels included in this study allocate around 20 per cent of available marks to internally-assessed tasks; this is with the exception of the Edexcel A level in Mathematics, which contains no internally-assessed content. In other education systems, however, the study of mathematics is no less likely to be internally-assessed than any other subject. Several mathematics qualifications involve school-based assessment where up to 50 per cent of the final grade is made up of such assessment tasks. Such tasks can broaden a qualification and allow students to be tested on the application of IT, extended problem-solving and the use of mathematics as a tool for modelling, all of which cannot be tested in an examination environment.

[27] Recreative: literally, "create anew". A re-creative task is based upon source materials and requires the student to consider the content from an alternative viewpoint and produce a new text, often in a different genre from that of the original, which is supported by textual evidence from the original material.

Issue 10: Multiple choice

Multiple-choice questions are common in other education systems at senior secondary level. They are not common in A levels. Multiple-choice questions can be used to test large amounts of content and assess skills such as the ability to use the English language. These can be difficult to test by other means. Should we revisit the use of multiple-choice questions in A level assessments?

The A levels in the this study do not use multiple-choice questions in any of the external examinations studied. This absence of multiple-choice testing is in contrast to many of the international assessments and qualifications at senior secondary levels. Various education systems incorporate multiple-choice questions into their examinations and in some cases, these questions are demanding and enhance the assessment as a whole.

A limited number of qualifications or assessments rely on the use of multiple-choice questions throughout. One example of this is the Republic of Korea CSAT. The CSAT is entirely externally assessed through multiple-choice papers with five possible answers for each item. All subjects in the CSAT are assessed over the course of one day. The People's Republic of China *Gāokǎo* has a similar format, with all subjects tested over the course of three full days.

The heavy use of multiple-choice questioning in the CSAT and *Gāokǎo* is particularly relevant given their context. The examination duration for both of these is relatively short. With this time restriction a question style which tests a student's ability to recall the large amount of information they have acquired as part of the course, in a time-efficient manner, is an effective way to ensure testing of a large part of a curriculum in a short period of time. In the case of the Chinese system in particular, the volume of students taking the examination is also significant. Multiple-choice testing provides one of the most efficient and reliable options for marking. In these cases the use of multiple-choice questions is vital for the manageability of the test.

Other education systems draw on multiple-choice questioning to a far lesser degree. In these cases, multiple-choice items are most likely to be part of the assessment of mathematics and chemistry. In chemistry, the nature of the questions very much reflects the rationale of the course. Where a course emphasises the acquisition of knowledge, the questions require recall. Often such questions are in the form of multiple-choice items (see for example, the Alberta Diploma and the New South Wales HSC). The demand of these questions is variable. The multiple-choice questions in the Alberta Diploma chemistry examinations require simple recall from the syllabus, logic and analysis or recognition, with very little opportunity to test higher-order thinking skills.

In the mathematics element of the Alberta Diploma, 82 per cent of the total marks available for the final examination are awarded for multiple-choice questions. The demand of the questions was judged to be significantly lower than that of A level Mathematics. Similar findings were made about the use of multiple-choice items in the HKDSE and the ACT test.

However, there are examples of assessments where multiple-choice questioning has been used to build greater demand. The People's Republic of China *Gāokǎo* and the Republic of Korea CSAT employ extremely stretching multiple-choice questions. These questions are often worth a significant number of marks but there is no facility for part-marks and students lose just as many marks for one arithmetical slip as for a non-attempt of the question or a wild guess.

Whilst A level Mathematics and Chemistry do not currently include multiple-choice questions, they do incorporate a number of short-answer questions. In contrast, the assessment of A level English and History include none of these short-answer questions; assessment is instead based on extended essay and source questions. This is therefore a significant difference in approach when we consider that in many of the international qualifications or assessments studied, multiple-choice questions are also used to assess these disciplines.

In both English and history, the most demanding style of question tends to be the extended, unstructured questions requiring substantial argument and synthesis. Despite this, this study found that multiple-choice items can also be demanding, depending on the content and skills that they are designed to test. They are also useful in varying the pace of an examination and catering for the lower-achieving students. However, if over-used they may also hamper the more able, especially when used to test unseen material. Multiple-choice questions are not suitable for some of the key skills involved in the study of certain subjects. In English, for example, it is impossible for students to undertake critical responses to texts (apart from those offered in the answer options) through multiple-choice questions. This prevents students from demonstrating skills considered very important for entry to a UK university to study English-related subjects.

The ACT English Test uses multiple-choice questions to test students' understanding of the conventions of writing and rhetorical skills as demonstrated by texts. Similarly the ACT Reading Test uses multiple-choice questions to test students' understanding of prose passages. The texts are selected to represent materials commonly encountered in the first year of higher education. In this first test, the higher-attaining students are hampered by the rigid constraints of the multiple-choice format, and are prevented from demonstrating any flair, originality, opinion or nuanced understanding of writers' methods. However reading the unseen texts and successfully answering the volume of questions within the time allowed requires a high level of specific literacy and comprehension skills.

8.1 Next steps

This was the first study in our six-year research programme to investigate the demand of assessments commonly taken by learners internationally in comparison with those taken by learners in England.

Alongside our work on revising A level qualification and subject criteria, we are planning further international comparative studies to feed into other future reforms in the English qualification system. We have invited education systems to become involved in upcoming studies looking at assessments at lower secondary level and at upper primary level. We are also exploring the possibility of reviewing student work from other high-performing education systems, and investigating the features of independent research, projects and extended essays at senior secondary level across education systems.

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Appendix: Subject panel members and affiliations

Mathematics	Role	Organisation
Pat Morton	Panel leader	Independent
Sally Barton	Panel member	Joint Mathematical Council
Brian Crossland	Panel member	Independent
Mike Dixon	Panel member	Cambridge International A level / Pre-U
Neil Hendry	Panel member	IBO
Tony Holloway	Panel member	The Welsh Government
Joe Kyle	Panel member	Universities UK
Duncan Lawson	Panel member	Universities UK
Bronwen Moran	Panel member	Edexcel
Sara Neill	Panel member	CCEA (Regulator)
Keith Pledger	Panel member	Edexcel
Roger Porkess	Panel member	Joint Mathematical Council
Chris Thompson	Panel member	Board of Studies NSW – New South Wales, Australia
Kevin Wallis	Panel member	Independent
Johan Yebbou	Panel member	L'inspection générale de l'éducation nationale (IGEN)

Chemistry	Role	Organisation
Sarah Askey	Panel leader	Independent
Fiona Clark	Panel member	IBO
Anna Croft	Panel member	Bangor University
Derek Denby	Panel member	OCR
Gina Grant	Panel member	Board of Studies NSW – New South Wales, Australia
Ian Hotchkiss	Panel member	Independent
Stuart Jones	Panel member	The Welsh Government
Robert Maguire	Panel member	CCEA (Regulator)
Marie-Blanche Mauhourat	Panel member	L'inspection générale de l'éducation nationale – France
Joseph Newman	Panel member	Cambridge International A level / Pre-U
Rob Ritchie	Panel member	OCR
Yvonne Walls	Panel member	Independent

English	Role	Organisation
Jenny Stevens	Panel leader	Independent
Janice Ashman	Panel member	AQA
Adrian Beard	Panel member	AQA
Caroline Bentley-Davies	Panel member	Independent
Barbara Bleiman	Panel member	Universities UK
Russell Carey	Panel member	Independent
Don Carter	Panel member	Board of Studies NSW – New South Wales, Australia
Judith Catton	Panel member	New Zealand Qualifications Authority
Andrew Green	Panel member	Universities UK
John Hodgson	Panel member	NATE
Elmer Kennedy-Andrews	Panel member	CCEA (Regulator)
Ian McNeilly	Panel member	NATE
Julian Pattison	Panel member	Cambridge International A level / Pre-U
Alison Whitehurst	Panel Member	IBO

History	Role	Organisation
Dave Martin	Panel leader	Independent
Arthur Chapman	Panel member	Historical Association
Ian Connor	Panel member	CCEA (Regulator)
Jenny Gillett	Panel member	IBO
Richard Harris	Panel member	Historical Association
Elin Jones	Panel member	The Welsh Government
Jennifer Lawless	Panel member	Board of Studies NSW – New South Wales, Australia
Angela Leonard	Panel member	Edexcel
Sarah Richardson	Panel member	Universities UK
Geoff Stewart	Panel member	Edexcel
Patrick Walsh-Atkins	Panel member	Cambridge International A level / Pre-U
John Warren	Panel member	Independent
Alex Woollard	Panel member	Independent

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