Cambridge Assessment

On what principles should we base our curriculum?

Tim Oates| *ARD Group Director Cambridge Assessment*| November 2018

Grit

Angela Lee Duckworth

Creativity

Ken Robinson

Agency

OECD

Aspiration

Patel

Youth identity

Shanghai

‘The internet’

Sugatra Mitra

Priorities

Social Emotional Aspects of Learning

Environmental awareness

Knife crime

Parenting

Chess

British Sign Language

Early cancer recognition

And 140 more

Unreflective mantra….'this is important – it should go in the National Curriculum…'

Priorities - impact

Priorities are not principles

Priorities dominate domestic and international discourse

Confusion distorts longer term direction of travel

Individual benefit

Social (environment in addition) benefit

Economic benefit

Coles and Oates

Families of principles

Priorities are not principles

Priorities dominate domestic and international discourse

Confusion distorts longer term direction of travel

Principles of development and operation of systems

Fewer things in greater depth (Reynolds and Farrell; Oates)

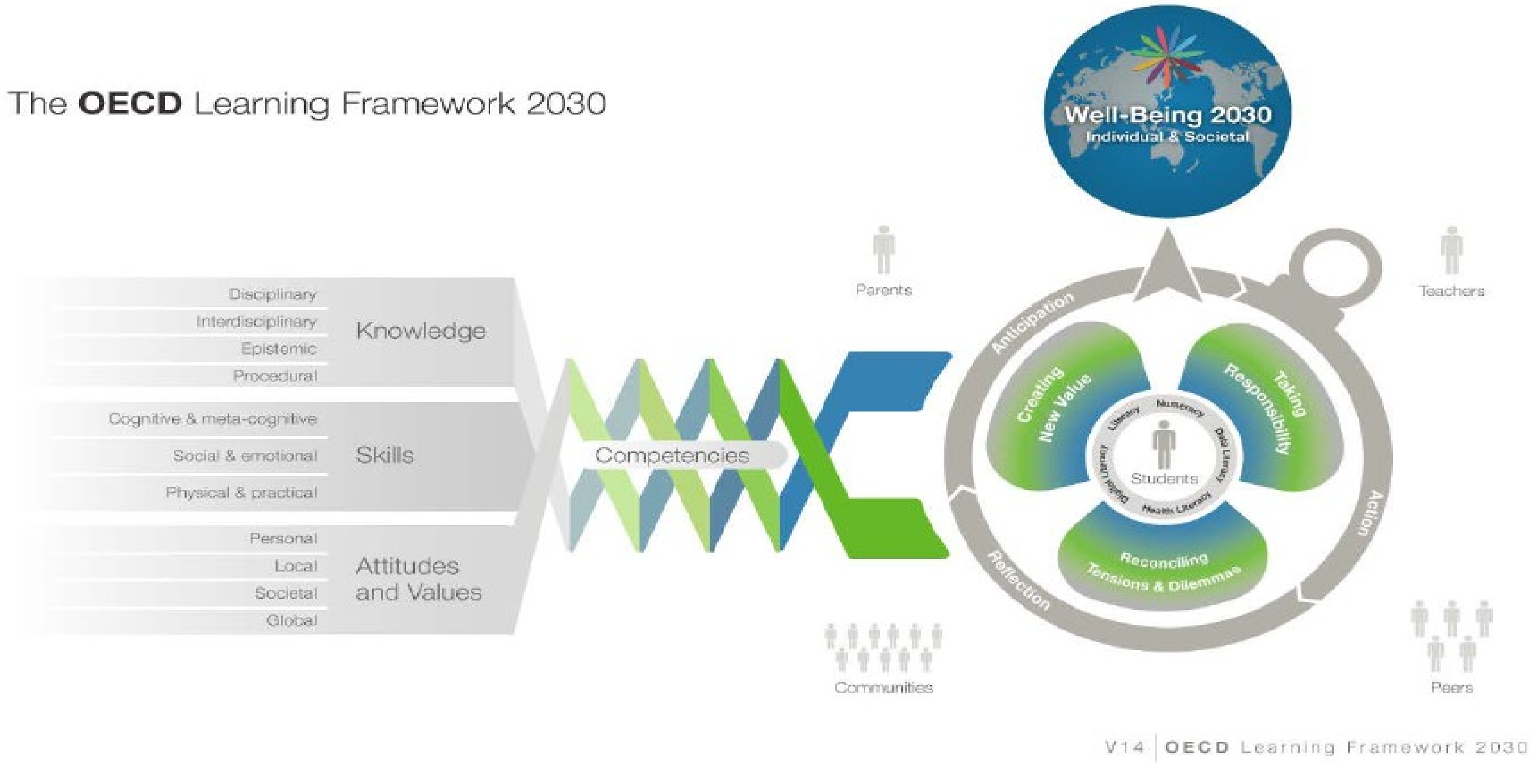
Rigour Focus Coherence (Schmidt)

Concepts Principles Fundamental operations Core knowledge (Oates)

National curriculum (standards) distinguished from School Curriculum (Eliott; Oates; Estonia)

Models of ability and progression (Morgan, Stigler, Nisbet, Oates)

Figure 1. The OECD Learning Framework 2030: Work-in-progress



Left hand side of OECD draft curriculum model

Disciplinary Interdisciplinary Epistemic Procedural →	**Knowledge**
Cognitive & meta-cognitive Social & emotional Physical & practical →	**Skills**
Personal Local Societal Global →	**Attitudes & Values**

Education for the future

'…Today, because of rapid economic and social change, schools have to prepare students for job that have not yet been created, technologies which have not yet been invented and problems that we don't yet know will arise…'

Andreas Schleicher – OCED Education Directorate 2010

‘Practical objectives of education’

I.

1) skills
2) culture
3) home membership
4) occupation
5) leisure
6) active citizenship

II.

7) physical development
8) aesthetic development
9) social development
10) spiritual development
11) intellectual development
12) moral development

Purpose in the curriculum (Nisbet S 1957)

Moral rationale

Education reform is the great social justice cause of our times. If we are to deliver a fairer society, in which opportunity is shared more widely, we must secure the highest standards of education for all young people, regardless of their background.

Nick Gibb Minister for Schools 9 July 2015

In England, the new curriculum, published in 1999 (QCA 1999a), included, for the first time, an explicit statement of aims, values and purposes. These were dominated by the Government's desire to raise pupil performance in literacy, numeracy and science, but also reflected the aim of promoting pupils' spiritual, moral, social, cultural, and physical growth, and preparing pupils for the opportunities, responsibilities and experiences of life. The explicit statement of values (QCA 1999b) focused on the self, relationships, society and the environment.

In Scotland, new guidelines for the curriculum for pupils aged five to fourteen, published in 1993 (SOED 1993), aimed to develop pupils' literacy, numeracy and science skills, at the same time as their abilities to communicate, express feelings and ideas, think critically, solve problems, and live healthily.

Shuayb M & O'Donnell S 2008

‘Curriculum’

Aims

Content

Pedagogy

Assessment

Evaluation

Eraut M 1998

Schmidt - TIMSS

Intended curriculum

Enacted curriculum

Assessed curriculum

Learned curriculum

Hattie, EEF, Coe, Crehan

‘Curriculum’

National curriculum

School curriculum

‘Curriculum renewal’ and ‘principles’

10 years or 30 years?

Chock full of contexts = need to renew regularly = political capture = reduction of capacity

Renewal cycle

What principles?

- Content (maths, history, chess, parenting)
- Form and function (autonomy issues, determining of pedagogy)
- Whose values, what values; what world, what direction?

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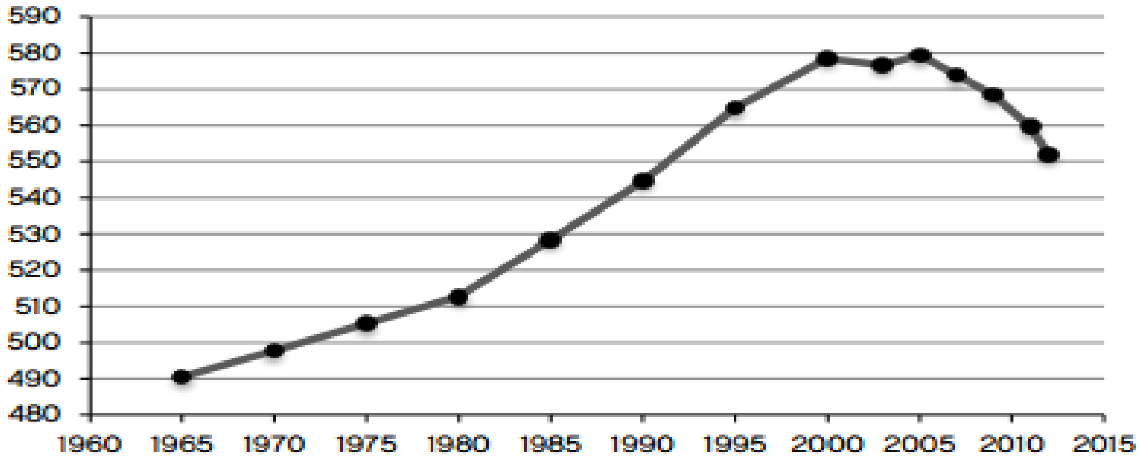
Chart 1: Finnish lower-secondary pupil performance in international assessments over time



From Real Finnish Lessons Heller Sahlgren 2015

Analysis in Finnish Fairy Stories Oates 2015

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‘Curriculum renewal’ and ‘principles’

Finland in the late 1940s

Singapore’s constant discussion – currently on stress, teacher quality

Shanghai and China on youth identity

OECD’s global discussion

Cambridge Assessment’s contribution

Accumulation of evidence – curriculum development as science

‘Curriculum renewal’

Domestic impact review – phase analysis – inspection reportage – primary research

Attainment and equity data

Progression and labour market analysis

Cultural and soclal commentary

Systematic transnational comparisons

Transnational survey data

Cognitive science – anthropological analysis – psychological research

Discipline research

Naïve ‘futurologists’

21Century skills

Suto on 21st C Skills ‘… most of them are not...’

‘Children do not need to remember anything any more… ’

On the contrary: Helen Abadzi on the limits of working memory

‘Children will not need to write in future… ’

Mangan & Velay: ‘traditional’ writing develops psychomotor co-ordination, suppression of infantile movement, planning, complex language (what, if, then) structured argument, cognitive development - Miskin: oral exposure, then writing

The importance of progression and returns analysis

False oppositions

1 knowledge versus skills
2 subjects versus themes
3 abstract versus concrete
4 rote learning versus understanding
5 didactics versus pedagogy
6 teacher-led versus individualised learning

Finland ‘direction of travel’ from 2017

http://www.phenomenaleducation.info/phenomenon-based-learning.html

In Phenomenon Based Learning (PhenoBL) and teaching, holistic real-world phenomena provide the starting point for learning. The phenomena are studied as complete entities, in their real context, and the information and skills related to them are studied by crossing the boundaries between subjects. Phenomena are holistic topics like *human, European Union, media and technology, water* or *energy*.The starting point differs from the traditional school culture divided into subjects, where the things studied are often split into relatively small, separate parts (decontextualisation).

This bit…..

where the things studied are often split into relatively small, separate parts (decontextualisation).

Which is complete nonsense. We can study Physics in a highly contextualised way within a subject structure. Indeed subject specialists are often the VERY BEST PEOPLE to allow good, well-grounded contextualisation. Wide ranging, individualised student study using a project method is a nightmare for ensuring deep learning supported by the right teacher expertise. These false oppositions and propaganda are extremely frustrating.

Scotland – Curriculum for Excellence

Just one more push…

A focus on ‘rich learning experiences’ rather than objectives and outcomes

Protracted problems

‘Subjects’

One context and presentation excite the understanding of one child, a different context another child. Multiple presentation and elaboration in context thus drives equity, and has an important role in identifying the ‘margins’ of understanding and the identification of misconceptions. But the salient points for arrangement into ‘subjects’ is this: the coherence of learning derives from the underlying focus on specific constructs. The dimensions of ***practice contexts*** (in maths, in language learning, in art) will vary dramatically. ‘Profit margin’ can be demonstrated in respect of contexts which vary to an extraordinary extent – from residential homes to insurance services. ‘Conservation of mass’ can be demonstrated through combustion and the dissolving of solids. ‘Subtraction’ can be acquired through removing buttons or porcupines. The contexts in varied presentation and practice necessarily vary greatly – they are linked only by virtue of the focus on the construct which is the object of learning. Discipline concepts exist in close relation: subtraction and addition; ratio, fractions and decimals; electrical charge, electromagnetic field, electron, proton; government, power, representation; and so on. This distinction - between concept and context, between the unity of groups of related underlying constructs and the necessary variation in contexts during acquisition and practice - supports not only the intensive focus on deep learning of specific concepts proposed by Young, but also provides a basis for the concept of a ‘discipline’ – of subjects. This line of thought does not provide a basis for the number of subjects which should be taught at specific ages, nor when specialisation should occur. But it provides a strong rationale for the concept of ‘discipline’ - focused acquisition of related constructs – and thus has strong implications for curriculum organization and pedagogy.

‘Subjects’

Cognitive load on teachers

Cognitive load on learners

Need for deep knowledge to contextualise, present, monitor and assess

Ken Robinson wrong about the history of the development of modern education – the ‘factory analogy’ – ‘factory schools’ does not mean that the schools were organised like a factory or served solely an economic purpose - just refer to Andy Green and Margaret Archer on the realities of Victorian education

EPPE project

Effective Provision of Pre-School Education

Sylva, Siraj-Blatchford, Sammons and Taggart

Balance of emotional, social and cognitive development

Categories for which we have evidence

Cognitive resources: concepts, principles, fundamental operations and core knowledge (Abadzi, Oates, Mellanby)

Combination: the way in which resources are brought to bear on contexts (Fischer)

Contexts: the tasks, activities and settings which are used both for purposeful activity and for learning (Morgan, Stigler & Stevenson)

Dynamic cycles of cognitive and brain development: Measuring growth in mind, brain, and education

Kurt W. Fischer

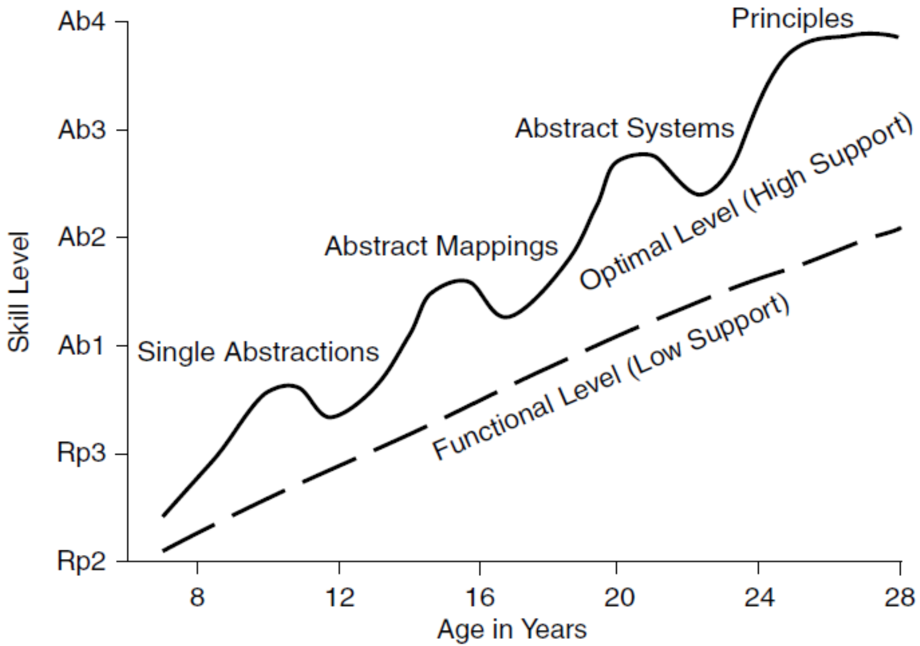

Figure 8.2 Cyclical spurts for cognitive development under optimal conditions.

https://www.gse.harvard.edu/~ddl/articlesCopy/FischerCyclesCognBrain.EducBrainCUP.pdf

Dynamic cycles of cognitive and brain development: Measuring growth in mind, brain, and education Kurt W. Fischer

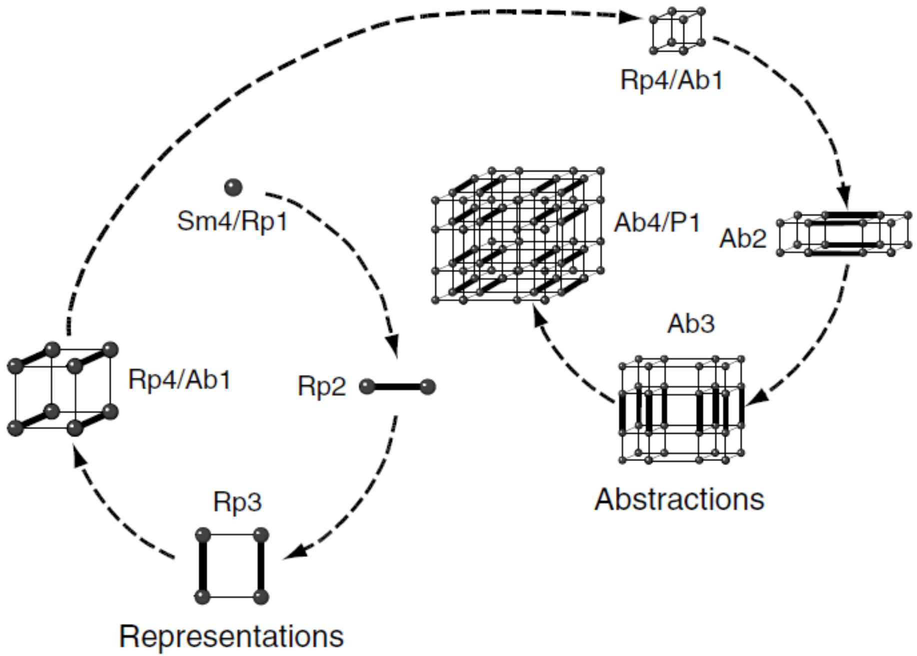

Figure 8.5 Developmental cycles for tiers of representations and abstractions.

https://www.gse.harvard.edu/~ddl/articlesCopy/FischerCyclesCognBrain.EducBrainCUP.pdf

Key focus of changes in UK National Curriculum

Reading & writing

Mathematical application

Oracy

Construct focus

Production

Practice

Exposure

Structural reform – the US case

USA

Full system reform – focus on attainment and equity
Evaluation analysis by Paul Peterson

1 No Child Left Behind – funding based
2 Federal Standards Initiative – standards based
3 School competition – structural focus

Variation in Charter school performance – it's what happens in the classroom…

But a recent surge in the adoption of the Common Core

Control factors – what we presented to the Sec of State in 2010

1. curriculum content
2. pedagogy
3. assessment and qualifications
4. institutional development
5. institutional forms and structures
6. governance
7. professional development
8. accountability
9. inspection
10. funding
11. national framework
12. selection and gatekeeping
13. information and guidance about routes and choices
14. allied social measures

So……..

Curriculum is heavily contested – from Dewey to Hirsch

International comparisons increasingly are helpful – Schmidt, Green, Oates

Aims and content decisions involve values - and that triggers contestation

The history of theory in curriculum is one of 'sprawl' and increasing complexity

Washback from formal assessment is a critical issue

A National Curriculum is not necessarily a curriculum

Assessment operationalises understandings of the specifics of the curriculum

Some organisations are increasingly active on 'international curriculum'

The curriculum field is full of untheorised 'futurology' and 'constructed fear'

'What' is studied IS important (eg subject choice at A level) but attainment is heavily determined by other factors – a fact that drives 'sprawling curriculum theory' – but what's 'ruled in' and what's 'ruled out'?

All of which poses problems for manageable definition of 'curriculum' in school inspection

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From the 2010 curriculum review in England

Curriculum coherence is crucial – a National Curriculum is one means of establishing this – note the conundrum regarding textbooks

Focus on concepts, principles and fundamental operations arranged in an age-related framework

Stable, sparse listing

Contextualisation should be controlled by teachers

Curriculum overload generates unconstrained 'local' choice and prioritisation

No slavish commitment to a common structure across subjects, bar attending to necessary links

Rapid action allied to appropriate long-term direction

Chemical Reactions

i. that when chemical reactions take place, mass is conserved;

j. that virtually all materials, including those in living systems, are made through chemical reactions;

k. to represent chemical reactions by word equations;

l. that there are different types of reaction, including oxidation and thermal decomposition;

m. that useful products can be made from chemical reactions, including the production of metals from metal oxides;

n. about chemical reactions, *e.g. corrosion of iron, spoiling of food,* that are generally not useful;

o. that energy transfers that accompany chemical reactions, including the burning of fuels, can be controlled and used;

p. about possible effects of burning fossil fuels on the environment.

National Curriculum 2007

Chemical and Material Behaviour

In their study of science, the following should be covered:

a. chemical change takes place by the rearrangement of atoms in substances;

b. there are patterns in the chemical reactions between substances;

c. new materials are made from natural resources by chemical reactions;

d. the properties of a material determine its uses.

2014 National Curriculum KS3 Chemistry

The particulate nature of matter

1. The properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure
2. Changes of state in terms of the particle model.

Atoms, elements and compounds

1. A simple (Dalton) atomic model
2. Differences between atoms, elements and compounds
3. Chemical symbols and formulae for elements and compounds
4. Conservation of mass changes of state and chemical reactions

Public and private goods of education

Discipline-specific knowledge, skills and understanding in broad range of disciplines

(Oates; Young; Warner & Jardine-Wright; Sehgal-Cuthbert; Standish; Silva & Taggart; Gramsci)

Orientation to learning, 'learning to learn'

(Deakin-Crick; Clark; Todd)

Physical and mental well-being

(Silva & Taggart; National Child Bureau; UNESCO)

Personal and social identity

(Neufeld; Luhtanen)

Personal capitals

(Bynner et al; Green)

Social capitals

(Schuller et al; Sylva & Taggart)

Cultural capitals

(Waters; Sullivan; Schroedler)

Moral, civic and political understanding, including international awareness

(Marguette & Mineshima; OECD; United Nations)

Facility in technology

(CAS; Knox; OECD; Laurillard)

Locations

Taught curriculum – subjects

Taught curriculum – cross curriculum elements

‘Taught’ curriculum – extra-curriculum elements

Expected activities outside school: school-home linkage – homework, parental support

Extra-curriculum elements – guided (school trips, link activities etc) unguided (student clubs etc)

Institutional participation – student councils etc, learner voice

Support elements – IAG etc

Ethos – values and value-driven practices

Culture – lived experience of the institution

Impact of incentives and drivers – eg labour market pressures, identity

Responsibilities and control

	Central Government
	Government Agency
	Local Government/intermediate bureaucracy
Aims	Governing Bodies
Content	Head teachers
Pedagogy	Middle tier management
Assessment	Teachers and assistants
Evaluation	Other staff
	Pupils
	Parents
	Other organisations – health organisations, police etc
	Exam boards and assessment organisations

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Aspects of curriculum and the controlling instruments

General duties	Curriculum Aims Safeguarding Ethos, behaviour codes, etc (Parenting, early cancer recognition)
Entitlement: detailed core outcomes	NC primary specs in science, maths and English including subject aims
Broad and balanced	Less detailed NC specs in other subjects including aims statements, non-NC subjects and enrichment elements

So far….

Complexity

Interactions and relationships

Controversy

Co-construction and social debate

The importance of the ‘aims’ statements

Purpose of study

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history’s most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject

.

The importance of the 'aims' statements

The national curriculum for mathematics aims to ensure that all pupils:

-become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.

-**reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language

- can **solve problems** by applying their mathematics to a variety of routine and non- routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

The importance of the 'aims' statements

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.

Information and communication technology (ICT)

Calculators should not be used as a substitute for good written and mental arithmetic. They should therefore only be introduced near the end of key stage 2 to support pupils' conceptual understanding and exploration of more complex number problems, if written and mental arithmetic are secure. In both primary and secondary schools, teachers should use their judgement about when ICT tools should be used.

Spoken language

The national curriculum for mathematics reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof. They must be assisted in making their thinking clear to themselves as well as others and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

School curriculum

The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study. In addition, schools can introduce key stage content during an earlier key stage, if appropriate. All schools are also required to set out their school curriculum for mathematics on a year-by-year basis and make this information available online.

Aims and content statement - Estonia

The aim of mathematics education is to develop in basic school students mathematics competence, which is adequate for their age; it means the ability to use the language, symbols and methods characteristic of mathematical applications to solve various problems in mathematics as well as in other school subjects and walks of life, to understand social, cultural and personal meaning of mathematics; the skill to formulate problems, identify and implement suitable solution strategies, analyse solution ideas and test the accuracy of results; the skill of logical reasoning, justification and proof by using and understanding different presentation methods.

The number of weekly mathematics lessons per stage of study is divided as follows: 1st stage of study – 10 lessons per week; 2nd stage of study – 13 lessons per week; 3rd stage of study – 13 lessons per week

Cultural and values – self-management – learning to learn

Aims and content statement - Estonia

2.1.4. Learning Outcomes and Learning Content of Mathematics in the 1st stage of study
The students:

Calculation Learning Outcomes

1) read, write, order and compare natural numbers from 0 to 10,000;
2) present a number as the sum of units, tens, hundreds and thousands;
3) read and write ordinal numbers;
4) add and subtract up to 100 mentally and up to 10,000 in writing;
5) recite the multiplication table (multiply and divide with a one-digit number up to 100 mentally);
6) know the names of the components and results of the four arithmetic operations;
7) find the numerical value of a letter in equations by means of trying or on the basis of analogy; and
8) determine the correct order of operations in expressions (parentheses, multiplication/division and adding/subtracting).

2014 National Curriculum Maths Year 1

1. Number - addition and subtraction

1. Pupils should be taught to:

- read, write and interpret mathematical statements involving addition (+), subtraction (−) and equals (=) signs
- represent and use number bonds and related subtraction facts within 20
- add and subtract one-digit and two-digit numbers to 20, including 0
- solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ? − 9

2014 National Curriculum Maths key stage 4

1. **Reason mathematically**

- extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations algebraically and graphically

- extend their ability to identify variables and express relations between variables algebraically and graphically

- make and test conjectures about the generalisations that underlie patterns and relationships; look for proofs or counter-examples; begin to use algebra to support and construct arguments {and proofs}

Sample statements – Kuwait NC - grades 6-9

1.2. Using listening strategies such as identifying the main idea, asking relevant questions and making simple predictions when listening to native/ nonnative English speakers.

1.2. Using listening strategies such as identifying the main idea, asking relevant questions for clarification, making simple predictions and paraphrasing when listening to native/nonnative English speakers.

1.2 Using listening strategies such as identifying the main idea, asking relevant questions for clarification and elaboration, making simple predictions, paraphrasing and distinguishing facts and opinions when listening to native/non-native English speakers.

1.2. Using listening strategies such as identifying the main idea, asking relevant questions for clarification and elaboration, making simple predictions, paraphrasing and comparing facts and opinions when listening to native and non-native English speakers.

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Sample statements – Kuwait NC - grades 6-9

Differentiating

Differentiate between exact data and approximate data.

1.11. Identify precision, and approximation in a variety of contexts

Example:

Fatima's family comprises 10 members. They went with Hessa's family of8 members to picnic, where they spent about 6 hours. Then they altogether went to a restaurant for lunch. They spent approximately one and half hour there. From the paragraph above, the student give one example of exact / approximate data.

Identify situations in which exact data and values are needed compared to situations in which approximate data and values are needed.

Section 1

Finland

Curriculum matched to Examination

Examination

Curriculum

Examination	'aidinkieli' mother tongue	Foreign language (nine options) Second national language			Mathematics (ordinary or advanced level)	'Reaali' General battery of tests in Sciences and Humanities (12 options)		
Curriculum	Mother Tongue & Literature	A-language	B-Language	Other Languages	Mathematics	Environment & Science	Humanities & Social sciences	Arts, crafts & sports

Example: Humanities Student

Mother tongue: Swedish	Foreign language: English (A level)	Second national language: Finnish				General battery: History	
Mother Tongue & Literature	A-language	B-Language	Other Languages	Mathematics	Environment & Science	Humanities & Social sciences	Arts, crafts & sports

Example: Science Student

Mother tongue: Finnish	Foreign language: English (B level)			Mathematics (advanced level)	General battery: Physics		
Mother Tongue & Literature	A-language	B-Language	Other Languages	Mathematics	Environment & Science	Humanities & Social sciences	Arts, crafts & sports

Section 4

USA

Colorado Curriculum

There is no nationally set curriculum in the USA and individual states set their own laws.

Colorado is used here as an example of the curriculum and assessments that a high school student may take

There is no set state-wide curriculum. The 'Colorado academic standards' (CAS) outline the expectations for students at all age levels.

Individual school districts then design curricula that align with the state standards

There are CAS standards for
•The Arts (Dance, Music, Drama &Theatre Arts, and Visual Arts

- Comprehensive Health & Physical Education
- Mathematics
- Reading, Writing and Communicating
- Science
- Social Studies
- Visual Arts
- World Languages
- Standards in Computer Science are currently being developed

Colorado Examinations

There are several exams that high school students in Colorado take:

Colorado Measures of Academic Success (CMAS)

-These are state tests used to evaluate students mastery and progress in the Colorado Academic Standards.

-Are taken at various points throughout school from Grade 3

-In Grade 11 only CMAS Science is required to be taken

-Previously they took CMAS Social Studies- but this was discontinued in 2017

-Parents may choose for their children to ‘opt out’ of these

-In 2016 the participation rate for high school students was 58.1% (34,383)

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The SAT

Additionally, as of 2017, 11th Grade Students in the USA take the SAT as their college entrance exam (previously they took the Colorado ACT)

The SAT tests are:

- Evidence based Reading and writing
    - Reading Test
    - Writing and Language Test
- Math
- Essay (Optional)

Advanced Placement

Students may also choose to take AP courses which are optional college-level courses.

There are seven course categories:

-AP Capstone (2 courses, designed to equip students with research, teamwork and communication skills)

- Arts (5 courses)
- English (2 courses)

-History & Social Science (9 courses)

-Maths & Computer Science (5 courses)

-Sciences (7 courses)

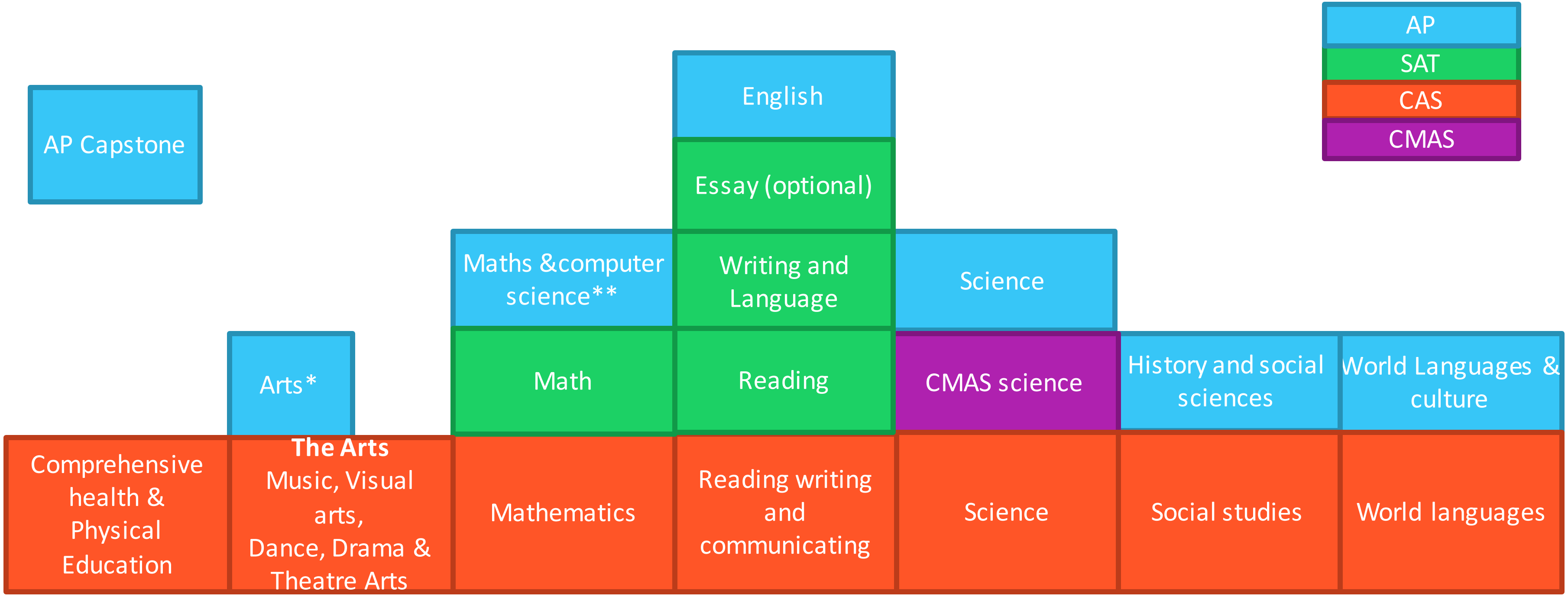
-World Languages & Culture (8 courses)

Students then take examinations in the AP courses they have taken (although approximately 34% of students enrolled in AP courses do not take the AP examination).

In 2016, the most common number of AP courses taken was one (54.4%), or two (24.4%).

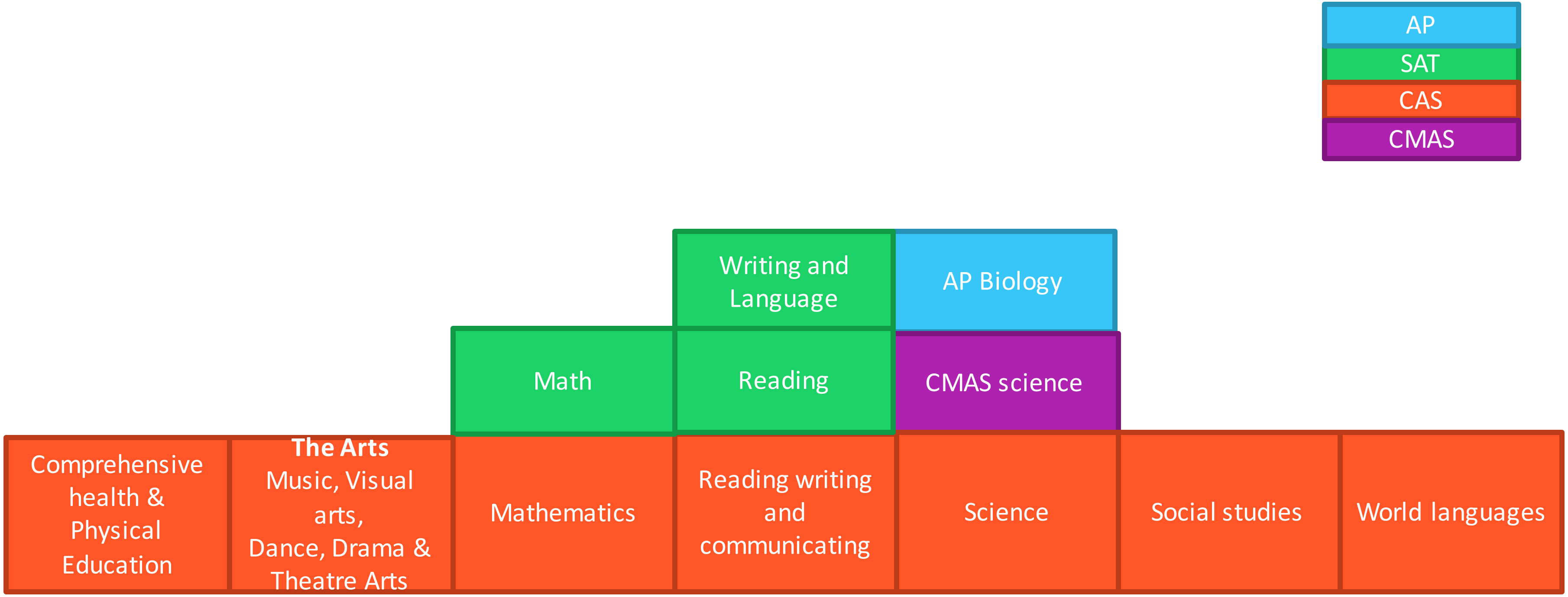
In Colorado there were 47,505 students who entered for 80,434 examinations in 2015-16.

Curriculum and Examinations



* There are no Dance or Drama and Theatre Arts in the Arts AP courses
** Computer Science CAS are currently under development

Example Science Student



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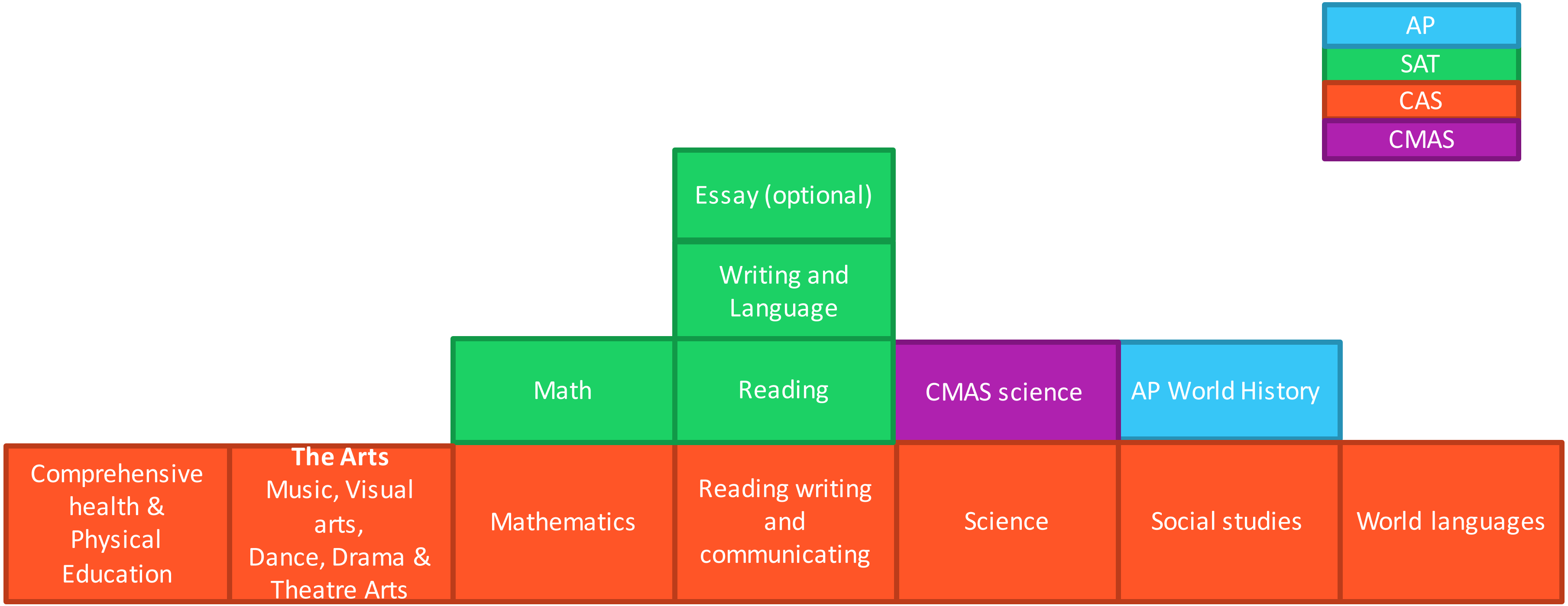
Example Humanities Student



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