



# Quality matters in learning materials – but what do we mean by ‘quality’



# Where are we now with learning resources?

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A rhetoric of ‘the future’s digital...’ – which can miss the point

Lower costs of entry

Difficult to capture and monetise innovation – openness of quality

Increasing regulation – continuing state interest

Digital companies hungry for return

In England – insidious effects of post-modern rhetoric

Narrow instrumentalism

Widespread failure to recognise the function of textbooks – now shifting

Government interest – attention, emphasis, funding, approval, regulation

Transnational comparative work on quality and function – Michigan, Cambridge

A start on self-improvement

# 2010 Review of the National Curriculum in England

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Detected the vital role of textbooks in conveying the intentions of a National Curriculum

Reviewed the approach to textbook production and approval in a range of high performing jurisdictions

Initially reviewed over 200 textbooks in primary and secondary phase, using information element and writing frame analytics

Examined research on textbook usage internationally and domestically

Worked with UK Government and publishers on renewal strategy including reconfiguring supply and demand, development of principles for high quality materials, researched approaches to high quality digital materials

# A priority in system improvement in England

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In England, during the 1980s and 1990s, there was a tendency towards a carefully-managed linkage between qualifications and textbooks/resources (Nuffield Biology, Suffolk Science, School Mathematics Project) – although an anti-textbook orthodoxy began to dominate teachers' thinking, stimulated by specific models of learning

England had no experience of the precise impact of high accountability arrangements; they have driven extreme instrumentalism into resources and textbooks

Textbooks seen as 'part of the steering mechanism' of education in Finland, and many high performing jurisdictions use an 'approved textbook' model

Stigler and Stevenson, Reynolds and Farrell find that highly effective teachers welcome high quality textbooks

Textbooks and resources are not simple, nor should they be seen as 'an afterthought'

# The future is digital – only it's just not that simple

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Analysis of the role of textbooks in system improvement and system regulation

Analysis of the key distinctions in form, function and reception of digital resources – 'Digital is Different'

# Who are textbooks for?

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## Directly

- Teachers
- Pupils (including writing in them)

## Indirectly

- Parents
- Awarding bodies
- Publishers
- The State
- Society

# Complex relations – not ‘top down imposition’

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Finland – learning materials central to system

Hong Kong – carefully created market model

Singapore – vital underpinning research combined with high text form control and accompanying training/continuing professional development

Shanghai – vital role of textbooks in distilling good practice

# Maths

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The 2011 the Trends in International Mathematics and Science Study (TIMSS) survey included collection of data on countries' use of textbooks and worksheets either as 'a basis of instruction' or to 'supplement' instruction:

Percentage of students whose teachers use...



# Maths

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	England	Singapore	Finland
Textbooks as a basis for instruction	10	70	95
As a supplement	64	23	3
Workbooks or worksheets as a basis	11	71	37
As a supplement	78	29	61
Concrete objects or materials	39	34	15
As a supplement	59	66	83
Computer software as a basis	24	16	5
As a supplement	74	80	69

(Mullis et al 2012)

# Science

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Percentage of students whose teachers use...

	England	Singapore	Finland
Textbooks as a basis for instruction	4	68	94
As a supplement	45	27	6
Workbooks or worksheets as a basis	4	69	40
As a supplement	82	31	54
Science equipment and materials as a basis	62	60	7
As a supplement	38	40	90
Computer software as a basis	15	19	1
As a supplement	74	78	61

(Martin et al 2011)

# Principles: The Cambridge approach to high quality textbooks and resource materials

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## Aim and Purpose

The materials should be clearly targeted and their intended patterns of use made clear – aim and purpose. This should include clarity as to which group(s) the materials are aimed:

- Teachers/trainers/educators
- Pupils/learners
- Parents
- Technicians
- Learning assistants
- Other

# Mixing of modes and functions

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## A suite of materials for science for 11-16 year olds

Teachers' guide to a 11-16 science scheme

Teachers' textbook with model lessons and a teaching sequence

Set of pupil workbooks which include homework and practice activities

Guide for running practical activities, providing a list of model experiments

Linked on-line assessments

On-line enrichment activities

# Strategy in England

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## Textbooks count – Nov 2014

There is an unacceptable level of market failure

A degree of collectivism may be an antidote

Quality needs to be defined and asserted through mutual critique and re-oriented competitive focus

Long term strategy asserts the public good

# Fitting learning resources into a wider policy framework

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1. Curriculum content (inc specifications, support materials, etc.)
2. Assessment and qualifications
3. National framework for qualifications
4. Inspection
5. Pedagogy
6. Professional development
7. Institutional development
8. Institutional forms and structures (e.g. size of schools, education phases)
9. Allied social measures (linking social care, health care and education)
10. Funding
11. Governance (autonomy versus direct control)
12. Accountability arrangements
13. Labour market/professional licensing
14. Allied market regulation (e.g. health and safety legislation, insurance regulation)

From Oates T 2010 Could do better: using international comparisons to refine the National Curriculum in England  
Cambridge Assessment

# Case study

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Myths: Finland's improvement is caused exclusively by a shift to school autonomy AND 'Finland is top of the table'

5.3 million population

Commits the historical error of 'what it is like now is how it got there'

Ignores trajectory

Misses existing forms of restriction (curriculum time, routes post-16, A Levels)

Dirigiste control to effect a fully comprehensive system – the importance of ideas

Regulation of textbooks until 1990/94

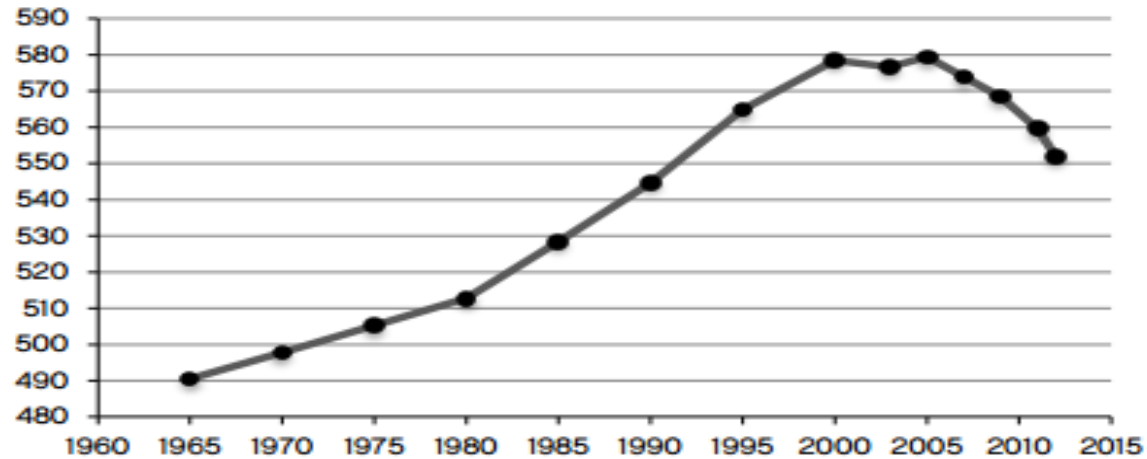
Student association review of textbooks

Textbooks theorised as part of the 'steering system' of general education

Teachers highly respected – qualified to MA level; high demand for places – pay = Organisation for Economic Co-operation and Development (OECD) average – teacher training colleges centres of organised reaction against Soviet occupation

Location of restriction; retaining qualifications, emphasising high quality teacher training, less visible data monitoring

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



Real Finnish Lessons Heller Sahlgren 2015



## Stand out element – Reynolds and Farrell

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Concentration on a small number of attainable goals, mostly of an academic variety or concerned with the individual's relationship to society, rather than a spread of effort across many academic, social, affective and moral goals.

Mechanisms to ensure that things are taught properly the first time around, and that there is no 'trailing edge' of children who have to be returned to later (an example from Taiwan is that children have to repeat in the homework books any exercises that they got wrong in their previous homework).

The use of the same textbooks by all children, which permits teachers to channel their energy into classroom instruction and the marking of homework, rather than into the production of worksheets that is so much a feature of English teaching.

Reynolds and Farrell 1996 p56

# Case study

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The error of the 'single point of authority' orthodoxy

The error of 'top down imposition'

Complex bottom-up – top-down development and purpose of textbooks

Japan – lesson observation

Singapore – history of development of maths materials

Shanghai – extraction from practice

Singapore – outcomes of digital pilots

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每盒水果糖重100 g, 3盒有多重?

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Shanghai: interesting issues of sequencing; and research-based production and refinement of textbook material

# Conclusion?

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The power of textbooks and resources (as encoding of good practice, as support, needs to be recognised fully)

Jump straight to State-approved textbooks? State approval not the only route to quality

There should be far greater deliberation over design content and use – resources are central to appropriate ‘curriculum control’

## **Textbooks: their historical role as vital instruments for implementing a national curriculum (2013 Review)**

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### **Alberta**

Authorised texts in core subjects

Approved by 'Alberta Learning'

Alternative texts available in approved lists, giving teacher choice

### **Massachusetts**

No centralised textbook acquisition

However, there exist centres of research and advice such as Associated Industries of Massachusetts (AIM)

### **Hong Kong**

Textbooks approved by Hong Kong Education Bureau

Schools are able to choose from a range of approved resources

### **Singapore**

Textbooks approved by Ministry of Education

Schools are able to choose from a range of approved resources

## **Textbooks: their historical role as vital instruments for implementing a national curriculum (2013 Review)**

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### **Finland**

Currently no explicit processes of State approval

Until early 1990s textbooks approved by Examining Office of the National Board of Education

### **England**

No processes of State approval of textbooks

However, substantial control of maths and English resources in Primary education during the late 1990s

Powerful processes of 'endorsed textbooks' for examinations

2014 drive to enhanced quality based on international comparisons

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- Teachers/trainers/educators
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- Technicians
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- Other

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**For example:**

A suite of materials for science for 11-16 year olds

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## Determining patterns of use:

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High quality materials typically include clear statements of ‘how this textbook should be used and the purpose of different elements in the text’.

1. Extend and supplement learning and be used outside contact time - does it structure and support home learning, learning beyond ‘timetabled’ time on subject, etc.
2. Supply reference material and/or activities which can be used in a highly flexible way by teachers
3. Provide structured activities which support or replace a very specific segment or segments of a learning programme
4. Provide a series of activities and content specifications which specify the sequence of learning and condition the learning activities

The degree of structuring and prescription of learning activities, and support to learners should be clear and justified/underpinned by evidence.

# Domain and construct specification – high integrity in construct specification

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The materials should specify clearly the domain which is covered:

Focus: specific discipline focus; cross curriculum focus etc.

Scope: specification of the ‘domain’ covered by the materials

Construct base: clear expression of the concepts, principles, fundamental operations and knowledge which is the focus of learning

Organising principles for domain specification: ‘big ideas in the subject’; ‘topics’; ‘related ideas’ etc.

Other structuring principles: use of practice; extended reading, etc.

Links to assessments and qualifications, including ‘extending beyond the specification’

# Educational models driving the materials

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Ideas regarding ability and progression can exert a powerful influence on the form and content of materials.

**Deep learning – sequencing, spiral curriculum, rehearsal, concept checks**

**Ability – differentiation**

**Practice**

**Production**

**Exposure**

# Approach to assessment

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- How is the assessment scheduled in the materials?
- Who undertakes the assessment?
- How formal is the assessment?
- What is the purpose of assessment?
- Approach to standards setting/facility estimations/age standardisation?
- Does the assessment produce information of value to the teacher and to the learner?
- How are the assessments marked, is it externally validated, are mark schemes provided ?
- Is there assessment of pre-requisites for each segment of learning?
- Are there 'quick concept checks' to highlight key constructs and give rapid feedback?
- Are there assessment approaches which encourage learner reflection– e.g. a 'learning journal' or 'short reflections'?
- Are there example exam questions to help the learner become accustomed to question form and content?
- What is the balance of different types of assessment?
- What is the balance between learning and assessment?

How dependable are assessments included in the materials, do they meet routine quality criteria regarding reliability, validity, construct integrity, consequential validity, and utility/manageability?

# Physical characteristics of materials, and production values

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- Size and format, consistent with aims etc.
- Durability, consistent with intended patterns of use
- Relation between aims, authoring process and design, editorial processes
- Surface features consistent with learning model and other key principles
- Templates which are consistent with the structure of knowledge and the aims of the materials
- Justification provided for each information element and activity
- Has ethical review of the materials been undertaken
- Compliance with national guidelines on language, images etc.

## Training & support (CPD – Continuous Professional Development) alongside the materials

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- What model of continuing professional development (CPD) is used in the supporting CPD – what is the scheduling, content etc?
- Is CPD available to all consumers of the materials?
- What is the costing model for the CPD?
- What is being done regarding CPD, scope, content, underlying assumptions and models – is the content of CPD consistent with the models in the materials?
- Are there means of evaluating the impact of CPD?

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## **Market and marketing**

- Projected sales volumes – what is the estimation of market?
- Nature of market and market competition – multiple suppliers etc.
- Marketing strategy
- Viability of costing model
- Relation to linked/parent qualification
- Endorsement strategy by Government, Awarding Body etc.

## **Underlying financial performance of the publisher**

- Standard audit issues regarding capacity and resilience
- Market presence, geographical coverage
- Established reputation

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## **Scheduling and production**

- Trialling and development schedule - the time allotted to the development process
- The extent to which the development is a refinement of prior materials and application of evaluation findings
- The form of the development process – single author, authoring team, etc.
- Trialling in development – with whom, how is it managed, what analysis and application of findings
- Have all necessary permissions for material been obtained?
- Are all legal agreements with authors regarding intellectual property etc. been put in place
- Lead time, publication/availability dates
- When CPD can be made available



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## **Evaluation and revision**

- Evaluation and revision strategy – schedule and methods
- Impact analysis
- Reporting responsibilities and use of evaluation outcomes
- Analysis of standards of assessment and performance of learners
- Examination of learner performance – enhancement of attainment
- Gaps between intended and actual patterns of use

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## **Regulatory compliance and conflicts of interest**

- Materials and the development and marketing processes should comply with regulatory requirements obtaining within the jurisdictions in which the materials will be used
- Nature and extent of conflicts of interest
- Mitigation of conflicts

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**Teaching quality – perhaps the most vital factor of all (John Hattie)**

**How do textbooks relate to the quality of the enacted curriculum?**

**Misinterpreting Singapore – missing learning models and principles, misunderstanding surface features such as repetition**

# Hong Kong – secondary maths

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Pre-requisites

Review

Different forms of the equations of circles

Features of circles from the equations

Equations of circles from the different given conditions

Intersection of a straight line and a circle

Learning objectives

Problems

Check through assessment: 6 problems, 1 practice exam Q, 1 lively maths problem

Clear concepts/constructs

Good elaboration through application

Checking understanding

**Spiral curriculum model**

# Singapore – secondary maths

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Chapter overview – story, topic – engagement

Discover – learning outcomes

Use of diagrams explained

**Key ideas – concepts/constructs – margin notes – focus on concepts**

Worked examples

Did you know – interesting facts

Guidance on the use of a calculator

Exercises

‘Time out activity’

Journal writing task

Summary – recap and revision – checking main concepts

Revision paper

Ten-minute concept check

Review paper

Enrichment maths

# Last generation GCSE textbook – KS4 Geography

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Varied structure – complex

Higher tier elements

Lower tier elements

299 pages

Sample GCSE exam paper p11

# Maths Primary Text - example

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Error of negative numbers through temperature scales

Different scales

Polar bears

Penguins

Icebergs

Construct irrelevant variation

# Primary text – the life cycle

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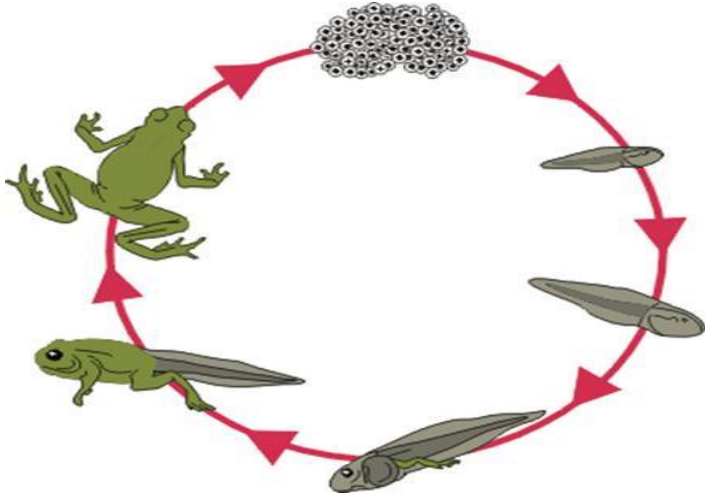
# Primary text – the life cycle

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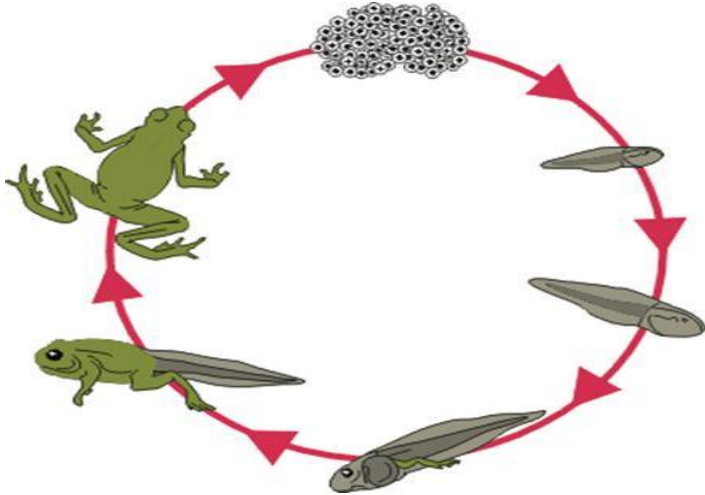
# Primary text – the life cycle - exposure

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# Primary text – the life cycle - exposure

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**New generation GCSE textbook –  
KS4 Maths**

# 1 Basic calculation skills

In this chapter you will learn how to ...

- use non-calculator methods to calculate with positive and negative integers.
- perform operations in the correct order based on mathematical conventions.
- recognise inverse operations and use them to simplify and check calculations.



For more resources relating to this chapter, visit GCSE Mathematics Online.

## Using mathematics: real-life applications

Everyone uses numbers on a daily basis often without really thinking about them. Shopping, cooking, working out bills, paying for transport and measuring all rely on a good understanding of numbers and calculation skills.



"Number puzzles and games are very popular and there are mobile apps and games available for all age groups. Our website offers free games where you have to identify the correct order of operations to use to solve different number puzzles."

*(Website designer)*



Tip

You probably already know most of the concepts in this chapter. They have been included so that you can revise concepts if you need to and check that you know them well.

Before you start ...

KS3	You should be able to add, subtract, multiply and divide positive and negative numbers.	<p>1 Copy and complete each statement to make it true. Use only <math>&lt;</math>, <math>=</math> or <math>&gt;</math>.</p> <p>a <math>2 + 3 \square 4 - 7</math>                      b <math>-3 + 6 \square 4 - 7</math>            c <math>-1 - 4 \square 20 \div -4</math>                    d <math>-6 \times 2 \square -7 - -5</math></p>
KS3	You should know the rules for working when more than one operation is involved in a calculation (BIDMAS).	<p>2 Spot the mistake in each calculation and correct the answers.</p> <p>a <math>3 + 8 + 3 \times 4 = 56</math>            b <math>3 + 8 \times 3 + 4 = 37</math>            c <math>3 \times (8 + 3) \times 4 = 130</math></p>
KS3	You should understand that addition and subtraction, and multiplication and division, are inverse operations.	<p>3 Identify the inverse operation by choosing the correct option.</p> <p>a <math>14 \times 4 = 56</math>            A <math>56 \times 4 = 14</math>                    B <math>14 \div 4 = 56</math>                    C <math>56 \div 4 = 14</math>            b <math>200 \div 10 = 20</math>            A <math>200 \div 20 = 10</math>                    B <math>200 = 10 \times 20</math>                    C <math>10 \times 200 = 2000</math>            c <math>27 + 53 = 80</math>            A <math>80 = 4 \times 20</math>                    B <math>80 - 27 = 53</math>                    C <math>80 + 27 = 107</math></p>



Find answers at: [cambridge.org/ukschools/gcsemaths-studentbookanswers](http://cambridge.org/ukschools/gcsemaths-studentbookanswers)

The constructed line is perpendicular to AB, so it is called the **perpendicular bisector** of AB.

Constructing perpendiculars

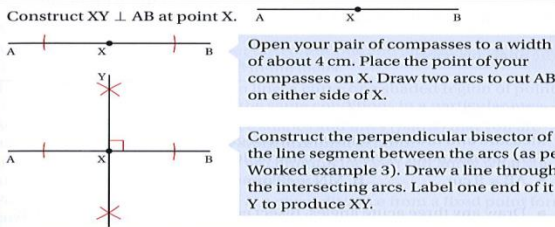
You can use your pair of compasses to construct:

- a line perpendicular to any point on a given line.
- a perpendicular line from a point above or below a given line.

Construct a perpendicular at a given point on a line

#### WORKED EXAMPLE 4

Construct  $XY \perp AB$  at point X.



Open your pair of compasses to a width of about 4 cm. Place the point of your compasses on X. Draw two arcs to cut AB on either side of X.

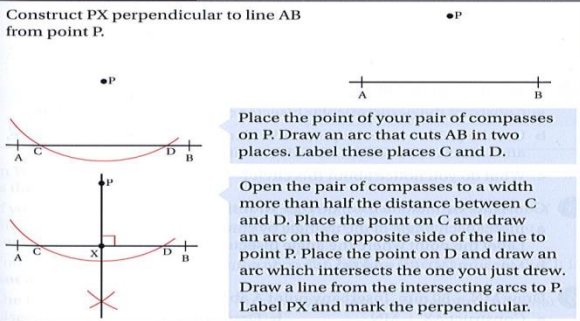
Construct the perpendicular bisector of the line segment between the arcs (as per Worked example 3). Draw a line through the intersecting arcs. Label one end of it Y to produce XY.

Construct a perpendicular from a point to a line

The shortest distance from any point to a line, is the perpendicular distance from the point to the line.

#### WORKED EXAMPLE 5

Construct PX perpendicular to line AB from point P.



Place the point of your pair of compasses on P. Draw an arc that cuts AB in two places. Label these places C and D.

Open the pair of compasses to a width more than half the distance between C and D. Place the point on C and draw an arc on the opposite side of the line to point P. Place the point on D and draw an arc which intersects the one you just drew. Draw a line from the intersecting arcs to P. Label PX and mark the perpendicular.



#### Key vocabulary

**perpendicular bisector:** a line perpendicular to another that also cuts it in half.



#### Tip

Remember perpendicular means 'at right angles to'.



#### Tip

Remember the symbol  $\perp$  means 'perpendicular to'; see Chapter 5 if you need to.

# Giving people what they need rather than what they want

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Are market forces enough?

Asymmetry and imperfections

Competing on 'quality' – but what does 'quality' mean?

The need for action

The need for moral purpose and ruthless self monitoring

The need for discussion and constant analysis

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**Bad textbooks are problematic, good textbooks are necessary  
but not sufficient**



# What are the features of a good textbook?

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Evidence-based in all its information elements and features

Informed by coherent underpinning learning model

Specifies the domain with precision and good structure

Specifies key constructs with precision and clarity, with all information elements and formatting reinforcing the key constructs

Includes high quality pre-assessment, on-going assessment and summative assessment

Practice, production, exposure

Curriculum and assessment linkage – but expansive, not instrumental

Ted Nelson 1987

‘...the question is not can we do everything on screens, but when will we, how will we, and how can we make it great? This is an article of faith – its simple obviousness defies argument...’

## Paradox

'...You will be destined for disappointment if your strategy is based on comparing the unmanaged disadvantages of the old with the utopian advantages of the new...'

# Singapore - Teach less, learn more

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# Singapore - Teach less, learn more

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Research on digital so far - Read more, learn less

# Singapore - Teach less, learn more

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## Research on digital so far - Read more, learn less

Paper beats computer screens – Science Nordic

Young people prefer to read on screen – BBC education

Reading on computer screens motivates boys to read – Literacy News

Computers 'do not improve' pupil results says OECD – BBC education

Finland – digital resources as systemic innovation – OECD

ILL Inter-library loan – the impact of on-line provision in library services

1970s-present – research on comprehension and recall

'...once I was a scuba diver in a sea of words...now I zip along the surface like a guy on a jet ski...'

Nicholas Carr 2008

Is Google making us stupid? What the internet is doing to our brains

'...is this digital versus paper just a cipher for a discussion about the philosophy of education; the things which make good education?...'

Battle of Ideas – London 2016



1



每盒水果糖重100 g, 3盒有多重?

$$100 \times 3 = 300(\text{g}) \quad \longrightarrow \quad \frac{1}{10} \times 3 = \frac{3}{10}(\text{kg})$$



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Shanghai: interesting issues of sequencing; and research-based production and refinement of textbook material

## Right now...

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Evangelists positing false oppositions – Richard Culatta

Highest quality developments are mixed media – Isaac; CUP

Quality variation and low initial concern for quality – Simon Peyton Jones

Wrong composition of development teams – IT versus pedagogy and assessment

Examples of successful implementation occurring – Chesterton versus East London

Those from lower SES are less able to use technology for learning

Self-directed learning presupposes skills not evenly spread re SES - Abadzi

Inadequate research on search behaviours and interest focus – schema

Inadequate research on demarcations in social sphere – what kids actually do

When does 'following preference' become systemic disadvantage – Oates

# Digital is different

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## Singapore 2012

Evaluation of development projects to implement electronic resources encountered significant practical difficulties regarding equipment and connectivity; but also difficulties in retaining the functions of previous paper-based materials

Plus significant findings from psychological studies of the use, learning processes and impact of digital materials

# Reading speed - writing speed

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Highly correlated with high attainment

Children who write more, think more. They are able to see and review their writing, and thus are able to reflect on the way they are thinking.

Teachers gain more insight into children's thoughts and provide more guidance and feedback

Writing enhances psychomotor co-ordination, a concern with precision, and a sense of 'audience'

Reading encourages persistence and attention as well as knowledge retention and thought

What is replacing writing in schools? – Eton and Harrow

Writing on screen is not identical to writing on paper

Autocorrection of spelling and grammar

Automatic legibility of print form

Ease of correction

# Subject schemas

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## Domain conception

The learner is naïve

Romantic conceptions of ‘natural’ growth

The specific nature of discipline knowledge

developing foundational concepts

identifying and immediately addressing misconceptions

making links and connections between concepts

consolidating and rehearsing

Confucian conceptions of learning

‘all children capable of anything depending on the way in which it is presented to them and the effort which they put into learning it...’

Guide

Authority

# Reading on screen is not identical to reading on paper

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Accessing behaviours – higher access, lower retention

Cognitive load

Attentiveness - distraction

Subject schemas

Domain conception

Sequencing learning – moving backwards and forwards

Retention of the ‘learning map’

Lower rate of supply of stimulus

‘The documentary replacing the essay’ – TES Oct 7th

The story from New York – ‘they just don’t...’ and differentiating social life and ‘learning’

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## **Infant and young learners**

inquisitive and curious but little conception of domain structure or specific concepts – the importance of exposure to, and development of, ‘complex language’

## **Adolescents**

more developed persistence combined with developed preferences

## **Changing social interactions**

Forms of discussion and interaction

Shifting power relationships

# Assets of digital resources

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Currently, specific motivation of young people regarding devices

Multiple modes of presentation – dynamic activities, visual, audio

Access to materials and data

Encouraging active engagement

Distinctive feedback relationships

Systems which respond to learning activities and assessment outcomes

Social contact during learning and in discussions about learning

Higher integration of instruction and assessment

Data capture regarding learners' activities and outcomes

New modes of assessment including formative and adaptive assessment



# Practical issues

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Bandwidth

Variation across education system and institutions

Device readiness and reliability

User competence regarding utility and navigation

Application failure

Configuration

Ease of editing is leading to poor attention to content and structure

Issues of triage regarding authority of sources

'Losing the learning moment' – the way in which skilled teachers can capitalize on learner engagement and motivation

## As with paper-based resources, function must be determined with precision

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Are specific resources intended to:

1. extend and supplement learning and be used outside contact time - does it structure and support home learning, learning beyond 'timetabled' time on subject, etc – homework diary, copies of worksheets, Isaac Maths, Maths Wizz,
2. supply reference material and/or activities which can be used in a highly flexible way by teachers – Youtube
3. provide structured activities which support or replace a very specific segment or segments of a learning programme – Pgonline, TSL online
4. provide a series of activities and content specifications which specify the sequence of learning and condition the learning activities – Pgonline

## **‘Digital learning’ – the crucial role of assessment**

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The variability of learning strategies and the lack of imposed curriculum structure highlights the importance of summative assessment – since learning activities can become more amorphous, there is greater importance in determining with precision the learning which has take place

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It is important to note that investment in new digital learning platforms has been extremely high yet, to date, take-up has been low

We do not understand adoption – let alone impact

Empirical studies show clearly that ‘digital is different’

There can be no simple assumptions about substitution of existing high quality resources

Curriculum confusions are not helping – Education 2030

Watch labour market return

Be careful what we wish for – we might just get it



**Tim Oates CBE**  
**Group Director of ARD**

