

14th Annual
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**Thinking &
Learning**
Conference

PROFESSOR DYLAN WILIAM

SATURDAY 20 MAY

**Overcoming a “Mile Wide, Inch Deep” Approach
to Curriculum: Principled Curriculum Design**

Session 1

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🌐 www.hbconf.com.au

✉ conferences@hbe.com.au

PROFESSOR DYLAN WILIAM

Professor Dylan Wiliam is emeritus professor of educational assessment at University College London. In a varied career, he has taught in urban public schools, directed a large-scale testing program, served a number of roles in university administration, authored numerous books, and pursued a research program focused on supporting teachers to develop their use of assessment in support of learning. As one of the United Kingdom's leading experts on assessment, Dylan has an extensive history of research and consultation in this area.



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Phone: (03) 8558 2444 Fax: (03) 8558 2400
Toll Free Ph: 1800 334 603 Fax: 1800 150 445
Website: www.hbe.com.au
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Overcoming a 'Mile Wide, Inch Deep' Approach to Curriculum:
Principled Curriculum Design

Dylan Wiliam (@dylanwiliam)

Outline

- What is curriculum?
- Seven principles for curriculum design
 - ▣ Balanced
 - ▣ Rigorous
 - ▣ Coherent
 - ▣ Vertically integrated
 - ▣ Appropriate
 - ▣ Focused/parsimonious
 - ▣ Relevant



What is curriculum?

Why do we educate young people?

- Broad views on the philosophy of education (Williams, 1961)
 - ▣ Transmission of culture (e.g., Arnold)
 - ▣ Preparation for work (e.g., OECD)
 - ▣ Preparation for effective citizenship (e.g., Freire)
 - ▣ Preparation for life



Curriculum: an evolving concept

- The courses taken (Scottish HE, late 17th century)
- Four questions (Tyler, 1949)
 - ▣ What educational purposes should the school seek to attain?
 - ▣ What educational experiences ... are likely to attain these purposes?
 - ▣ How can these educational experiences be effectively organized?
 - ▣ How can we determine whether these purposes are being attained?
- "All the learning which is planned or guided by the school, whether it is carried on in groups or individually inside or outside the school." (Kerr, 1968 p. 16)
- "the school curriculum (in the wider sense) is essentially a selection from the culture of a society." (Lawton 1975 p. 7)



What is curriculum *really*?

- Three levels of curriculum
 - ▣ The intended curriculum
 - The curriculum mandated by government agencies
 - ▣ The implemented curriculum
 - The curriculum realized in textbooks, schemes of work, lesson plans, etc.
 - ▣ The achieved curriculum
 - The lived daily experience of learners in schools
- Each of these has explicit and tacit (hidden) aspects



And what is not there is also important...

- The null curriculum:
“the options students are not afforded; the perspectives they may never know about, much less be able to use; the concepts and skills that are not part of their intellectual repertoire” (Eisner 1985, p.107).



Discussion

- Identify some elements of the hidden curriculum in your school/college/district/province
- Identify some elements of the null curriculum in your school/college/district/province

The role of teachers (Stenhouse, 1975)

- “A curriculum is an attempt to communicate the essential principles and features of an educational proposal in such a form that it is open to critical scrutiny and capable of effective translation into practice.” (p. 5)
- The proposal should have three parts:
 - A. In planning
 - B. In empirical study
 - C. In relation to justification



Myths about curriculum

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- Standards tell us what to teach
- Curriculum means textbooks
- Knowledge isn't important ("You can always Google it")
- Students should be involved in authentic tasks
- We should be teaching skills, not content
- Responding to students' interests closes achievement gaps



Why curriculum matters

Reading skills: what are they really?

"A manifold, contained in an intuition which I call mine, is represented, by means of the synthesis of the understanding, as belonging to the necessary unity of self-consciousness; and this is effected by means of the category."

What is the main idea of this passage?

- A. Without a manifold, one cannot call an intuition 'mine.'
- B. Intuition must precede understanding.
- C. Intuition must occur through a category.
- D. Self-consciousness is necessary to understanding


Hirsch (2006)



Perception in chess

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- Three chess players were shown a chess board for five seconds, and then asked to reproduce what they had seen.
- Two scenarios
 - ▣ Middle game (30 to 40 moves in, 25 pieces on board)
 - ▣ End game (80 moves in, 12 to 15 pieces on board)




Number of pieces correctly placed

14

	Real game situation		Random arrangement	
	Middle	End game	Middle	End game
Novice	5	4	2	1
Intermediate	9	7	3	2
Expert	16	8	3	3

Chase and Simon (1973)




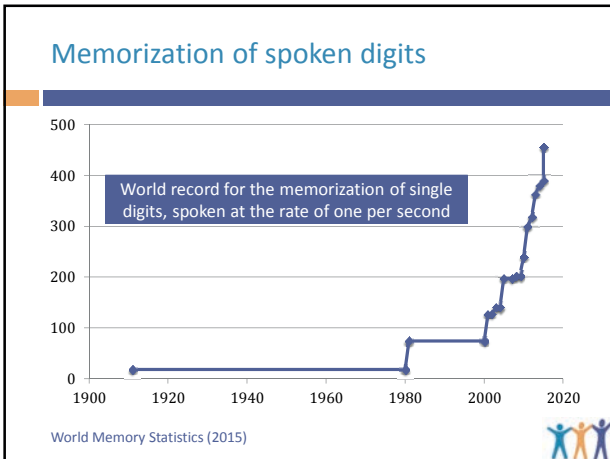
Countdown game

Target number: 127

25 3 1

 9 4





- ### Why curriculum really matters
- Short-term memory is limited
 - Capacity: a handful of things
 - Duration: a few seconds
 - Long-term memory is essentially infinite
 - Capacity: essentially infinite
 - Duration: lifetime
 - More knowledge in long-term memory makes the use of short-term memory more effective
 - The main purpose of curriculum is to build up knowledge in long-term memory

Principles of curriculum design

Principles of curriculum design

- A good curriculum is:
 - ▣ Balanced
 - ▣ Rigorous
 - ▣ Coherent
 - ▣ Vertically integrated
 - ▣ Appropriate
 - ▣ Focused/parsimonious
 - ▣ Relevant



Balanced: which subjects?

- | | |
|----------------------------|-----------------|
| □ English | □ Drama |
| □ Mathematics | □ Dance |
| □ Science | □ Chess |
| □ Technology | □ Engineering |
| □ Modern foreign languages | □ Geology |
| □ Geography | □ Astronomy |
| □ History | □ Media studies |
| □ Music | □ Law |
| □ Art | □ Psychology |
| □ Physical education | □ Sociology |
| □ Religious education | □ Politics |

Rigorous: subjects, disciplines, or skills?

- Disciplinary habits of mind are important, specific, powerful ways of thinking that are developed through sustained engagement with the discipline.
 - ▣ Mathematics: transformation and invariance
 - ▣ History: provenance and context
 - ▣ Statistics: dispersion as well as central tendency
 - ▣ Sociology: structure and agency



21st Century skills

- Cognitive competencies
 - ▣ Cognitive processes and strategies
 - ▣ Knowledge
 - ▣ Creativity
- Intra-personal competencies
 - ▣ Intellectual openness
 - ▣ Work ethic/conscientiousness
 - ▣ Positive core self-evaluation
- Inter-personal competencies
 - ▣ Team-work
 - ▣ Leadership

Pellegrino and Hilton (2012)



Coherent: subjects or themes?

- Subject-based curricula support disciplines but tend to undermine coherence across different aspects of learning
- Theme-based curricula support coherence, but tend to undermine disciplinary development



Reading skills: what are they really?

A manifold, contained in an intuition which I call mine, is represented, by means of the synthesis of the understanding, as belonging to the necessary unity of self-consciousness; and this is effected by means of the category.

What is the main idea of this passage? 1. Without a manifold, one cannot call an intuition 'mine.' 2. Intuition must precede understanding. 3. Intuition must occur through a category. 4. Self-consciousness is necessary to understanding

Hirsch (2006)



Reading skills: what are they really (part 2)

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"Thus, as the final day dawned and a near capacity crowd lustily cheered every run Australia mustered, much depended on Ponting and the new wizard of Oz, Mike Hussey, the two overnight batsmen. But this duo perished either side of lunch—the latter a little unfortunate to be adjudged leg-before—and with Andrew Symonds, too, being shown the dreaded finger off an inside edge, the inevitable beckoned, bar the pyrotechnics of Michael Clarke and the ninth wicket.

Clarke clinically cut and drove to 10 fours in a 134-ball 81, before he stepped out to Kumble to present an easy stumping to Mahendra Singh Dhoni." (The Guardian, January 19, 2008)

Flesch-Kincaid Reading Ease: 42.5

Grade level: 14



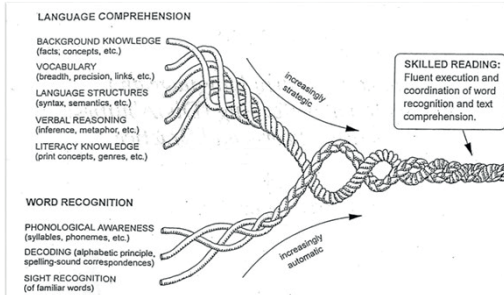
Lost in translation?

"Comprehension depends on constructing a mental model that makes the elements fall into place and, equally important, enables the listener or reader to supply essential information that is not explicitly stated. In language use, there is always a great deal that is left unsaid and must be inferred. This means that communication depends on both sides, writer and reader, sharing a basis of *unspoken* knowledge. This large dimension of tacit knowledge is precisely what is *not* being taught adequately in our schools."

Hirsch (2009 loc. 176)



Reading is complex...



(Scarborough, 2001)



Skill is content, content is skill

Five propositions about academic skills (Hirsch, 2009)

- 1 The character of an academic skill is constrained by the limitations of short-term working memory.
- 2 Academic skills have two components: procedures and contents.
- 3 Procedural skills such as turning letters into sounds must initially be learned as content, along with other content necessary to higher-order skills.
- 4 An advance in skill, whether in procedure or content, entails an advance in speed of processing.
- 5 A higher-order academic skill such as reading comprehension requires prior knowledge of domain-specific content; the higher-order skills for that domain does not readily transfer to other content domains.



Vertically integrated: emphasis on progression

In which order would you teach the areas of the following shapes (currently arranged alphabetically)?

- ▣ Parallelogram
- ▣ Rectangle
- ▣ Square
- ▣ Trapezium
- ▣ Triangle



Learning hierarchies

- ▣ Universal
 - ▣ Addition before multiplication
- ▣ Natural
 - ▣ Multiplication before division
 - ▣ Differentiation before integration
- ▣ Arbitrary
 - ▣ Areas of triangles before areas of parallelograms
- ▣ Optional
 - ▣ The Romans before the Vikings



The spiral curriculum

The "spiral curriculum." If one respects the ways of thought of the growing child, if one is courteous enough to translate material into his logical forms and challenging enough to tempt him in advance, then it is possible to introduce him at an early age to the ideas and styles that in later life make an educated man. We might ask, as a criterion for any subject taught in primary school, whether, when fully developed, it is worth an adult's knowing, *and whether having known it as a child makes a person a better adult.* If the answer to both questions is negative or ambiguous, then the matter is cluttering the curriculum.

Bruner, J. (1960). *The Process of Education*, Cambridge, MA: Harvard University Press, pp. 52-54 (my emphasis).



Kinds of spiral

- Kinds of spiral
 - Trivial: anything can usefully be revisited
 - Deep: spirals are an important part of a curriculum
- Inclusion criteria
 - You might need this later
 - You will need this later
 - This is useful now, even if you do not go further
 - You will need this later, and you will be significantly disadvantaged if you do not learn it now



From spirals to distributed practice


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- Traditional model of memory
 - Stuff gets learned
 - Over time, the memories fade
 - If we cannot remember things, the memories have gone
- "New theory of disuse" (Bjork, 1992)
 - Key distinction: Storage strength vs. retrieval strength
 - Once things get learned, they are never forgotten
 - But they can be hard to retrieve




Storage strength and retrieval strength


		Retrieval strength	
		Low	High
Storage strength	Low	The number of a hotel room you stayed in last year	The number of the hotel room you are staying in now
	High	The telephone number in your childhood home	A national insurance/social security number



Instructional design

- Main research finding: studying increases *storage* strength more when *retrieval* strength is *low*
 - ▣ Studying things when they are familiar (high retrieval strength) feels good, but is largely a waste of time (low impact on storage strength).
 - ▣ Studying things when they are unfamiliar (low retrieval strength) feels frustrating, but is highly effective (big impact on storage strength)
 - Key consequences
 - ▣ Distributed rather than massed practice
- 

Backward design

- The tragedy of life is that one can only understand life backwards, but one must live it forwards
(Søren Kierkegaard)
 - In the same way, curricula need to be designed backwards, but delivered forwards
 - Should a curriculum be specified in terms of
 - ▣ Experiences?
 - ▣ Outcomes?
 - ▣ Both?
- 

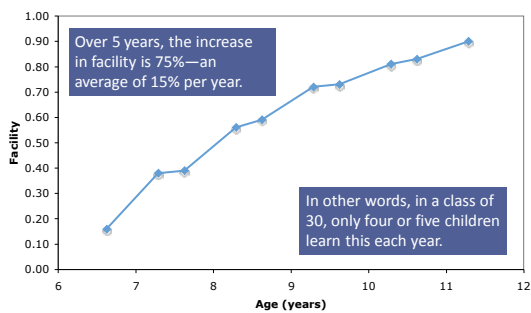
Curriculum for excellence: Dance

Through dance, learners have rich opportunities to be creative and to experience inspiration and enjoyment. Creating and performing will be the core activities for all learners, and taking part in dance contributes to their physical education and physical activity. Learners develop their technical skills and the quality of their movement, and use their imagination and skills to create and choreograph dance sequences. They further develop their knowledge and understanding and their capacity to enjoy dance through evaluating performances and commenting on their work and the work of others.

Scottish Government. (2007). "Curriculum for Excellence: expressive arts experiences and outcomes" p. 5.



Appropriate: 860+570=?

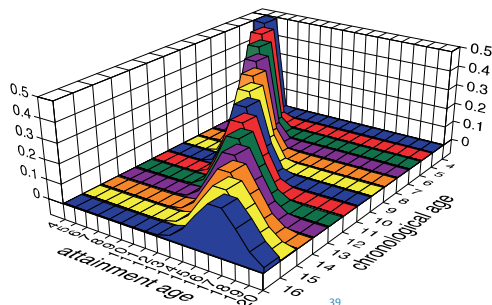


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Source: Leverhulme Numeracy Research Programme

Consequences (1)

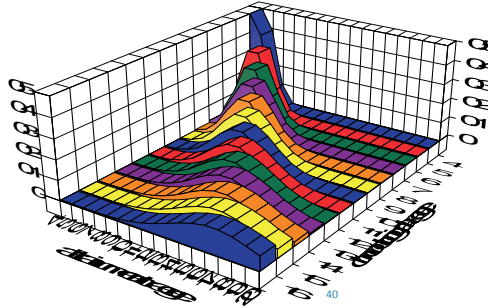
SD = chronological age/10



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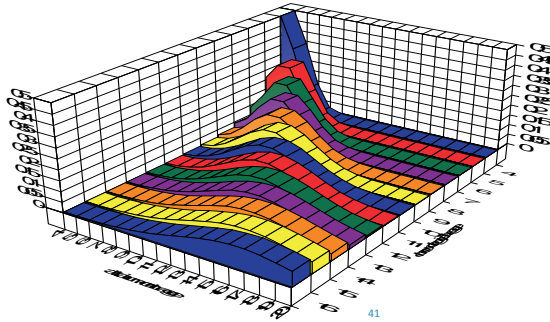
Consequences (2)

SD = chronological age/5



Consequences (3)

SD = chronological age/4



Age or stage?

Curriculum specified:	+	-
Year by year	Supports coherence across subjects Encourages "high-reliability" teaching	Restricts freedom for teachers to plan different sequences Promotes (requires?) atomisation of curriculum
By phase	Allows teachers to plan different sequences Encourages a focus on 'big ideas'	Difficult to ensure strong cross curricular links Allows unnecessary differentiation

Focused: Successful education

“The test of successful education is not the amount of knowledge that a pupil takes away from school, but his appetite to know and his capacity to learn. If the school sends out children with the desire for knowledge and some idea how to acquire and use it, it will have done its work. Too many leave school with the appetite killed and the mind loaded with undigested lumps of information. The good schoolmaster is known by the number of valuable subjects that he declines to teach. (Livingstone, 1941 p. 28)”



Big ideas of science (Harlen et al., 2011)

- 1 All material in the Universe is made of very small particles.
- 2 Objects can affect other objects at a distance.
- 3 Changing the movement of an object requires a net force acting on it.
- 4 The total amount of energy in the Universe is always the same but energy can be transformed when things change or are made to happen.
- 5 The composition of the Earth and its atmosphere and the processes occurring within them
- 6 The solar system is a very small part of one of millions of galaxies in the Universe.
- 7 Organisms are organised on a cellular basis.
- 8 Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms.
- 9 Genetic information is passed from one generation of organisms to another.
- 10 The diversity of organisms, living and extinct, is the result of evolution.

Big ideas about science (Harlen et al., 2011)

- 1 Science assumes that for every effect there is one or more causes.
- 2 Scientific explanations, theories and models are those that best fit the facts known at a particular time.
- 3 The knowledge produced by science is used in some technologies to create products to serve human ends.
- 4 Applications of science often have ethical, social, economic and political implications.



Relevant: informed choice

- About what to learn (Curriculum)
- About how to learn (Pedagogy)
- Degree of choice should be influenced by
 - ▣ Consequences (for the individual and for society)
 - ▣ Maturity
- Consequences of choices (and especially poor choices) about what is to be learned are generally greater than choices about how learning should be achieved, so
 - ▣ For younger learners, many if not most learning outcomes need to be non-negotiable. As they get older their wishes should become predominate their interests (progressive lowering of the "safety net")
 - ▣ From the earliest age, however, learners should be involved in decisions about how they learn best.



Informed choice about curriculum

- Intrinsic factors
 - ▣ What is the subject really like?
 - ▣ Authenticity of experience
 - ▣ Habits of mind
 - ▣ Developing identity (e.g., mathematics, plumbing)
- Extrinsic factors
 - ▣ "Critical filters" for particular careers
 - ▣ Financial rewards
- Consequences
 - ▣ Closing down of options ("leaky pipes")
 - ▣ Sensitive periods



Informed choice in mathematics

$$e^{i\pi} + 1 = 0$$

Euler's relation
F + V = E + 2



Goldbach's conjecture

The alternating harmonic series

$$= 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \frac{1}{7} - \frac{1}{8} + \frac{1}{9} - \frac{1}{10} + \frac{1}{11} - \frac{1}{12} + \frac{1}{13} + \dots$$



Principles of curriculum design

Discussion

- Which three of the seven principles of curriculum design do you think are most important?
- Which three of the seven principles do you think are least important?
- Could any of the principles be combined?
- What other principles would you add?

Discussion

- What knowledge do teachers need to develop a curriculum for effective thinking?

Principles for selection of activities

Principles for selection of activities (Raths 1971)

- All other things being equal, one activity is more worthwhile than another if:
1. it permits children to make informed choices in carrying out the activity and to reflect on the consequences of their choices.
 2. it assigns to students active roles in the learning situation rather than passive ones.
 3. it asks students to engage in inquiry into ideas, applications of intellectual processes, or current problems, either personal or social.
 4. it involves children with realia (i.e., real objects, materials and artefacts).
 5. completion of the activity may be accomplished successfully by children at several different levels of ability.
 6. it asks students to examine in a new setting an idea, an application, of an intellectual process, or a current problem which has been previously studied.
 7. it requires students to examine topics or issues that citizens in our society do not normally examine – and that are typically ignored by the major communication media in the nation.
 8. it involves students and faculty members in 'risk taking' – not a risk of life and limb, but a risk of success or failure.
 9. it requires students to rewrite, rehearse and polish their initial efforts.
 10. it involves students in the application and mastery of meaningful rules, standards, or disciplines.
 11. it gives students a chance to share the planning, the carrying out of a plan, or the results of an activity with others.
 12. it is relevant to the expressed purposes of the students.



Discussion

- Which of Raths' 12 principles would you rate as most important?
- Which of Raths' 12 principles would you rate as least important?

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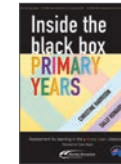
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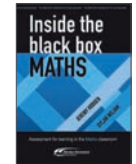
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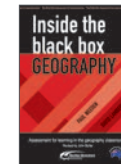
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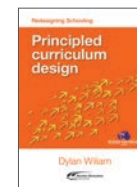
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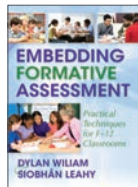
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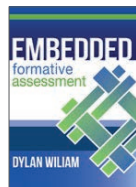
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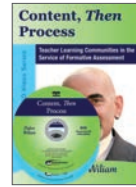
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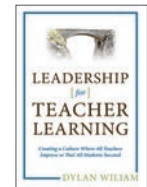
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