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Assessment for learning

Pennsylvania RtII Summer Institute
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Prolog

We need to improve student achievement
This requires improving teacher quality
Improving the quality of entrants takes too long
So we have to help the teachers we have improve

Science

Teachers can change in a range of ways
Some will benefit students, and some will not.
Those that do involve changes in teacher *practice*

Changing practice requires new kinds of teacher learning
And new models of professional development.

Design

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Raising achievement matters

For individuals

- Increased lifetime salary
- Improved health
- Longer life

For society

- Lower criminal justice costs
- Lower health-care costs
- Increased economic growth
  - Net present value to the US of a 25 point increase on PISA: $40 trn
  - Net present value to the US of getting all students to 400 on PISA: $70 trn

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There is only one 21st century skill

So the model that says learn while you're at school, while you're young, the skills that you will apply during your lifetime is no longer tenable. The skills that you can learn when you're at school will not be applicable. They will be obsolete by the time you get into the workplace and need them, except for one skill. The one really competitive skill is the skill of being able to learn. It is the skill of being able not to give the right answer to questions about what you were taught in school, but to make the right response to situations that are outside the scope of what you were taught in school. We need to produce people who know how to act when they're faced with situations for which they were not specifically prepared. (Papert, 1998)

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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 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 which he declines to teach.

The Future of Education **(Livingstone, 1941 p. 28)**

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Where's the solution?

Structure

- Smaller/larger high schools
- K-8 schools/"All-through" schools

Alignment

- Curriculum reform
- Textbook replacement

Governance

- Charter schools
- Vouchers

Technology

- Computers
- Interactive white-boards

Workforce reforms

- Classroom assistants

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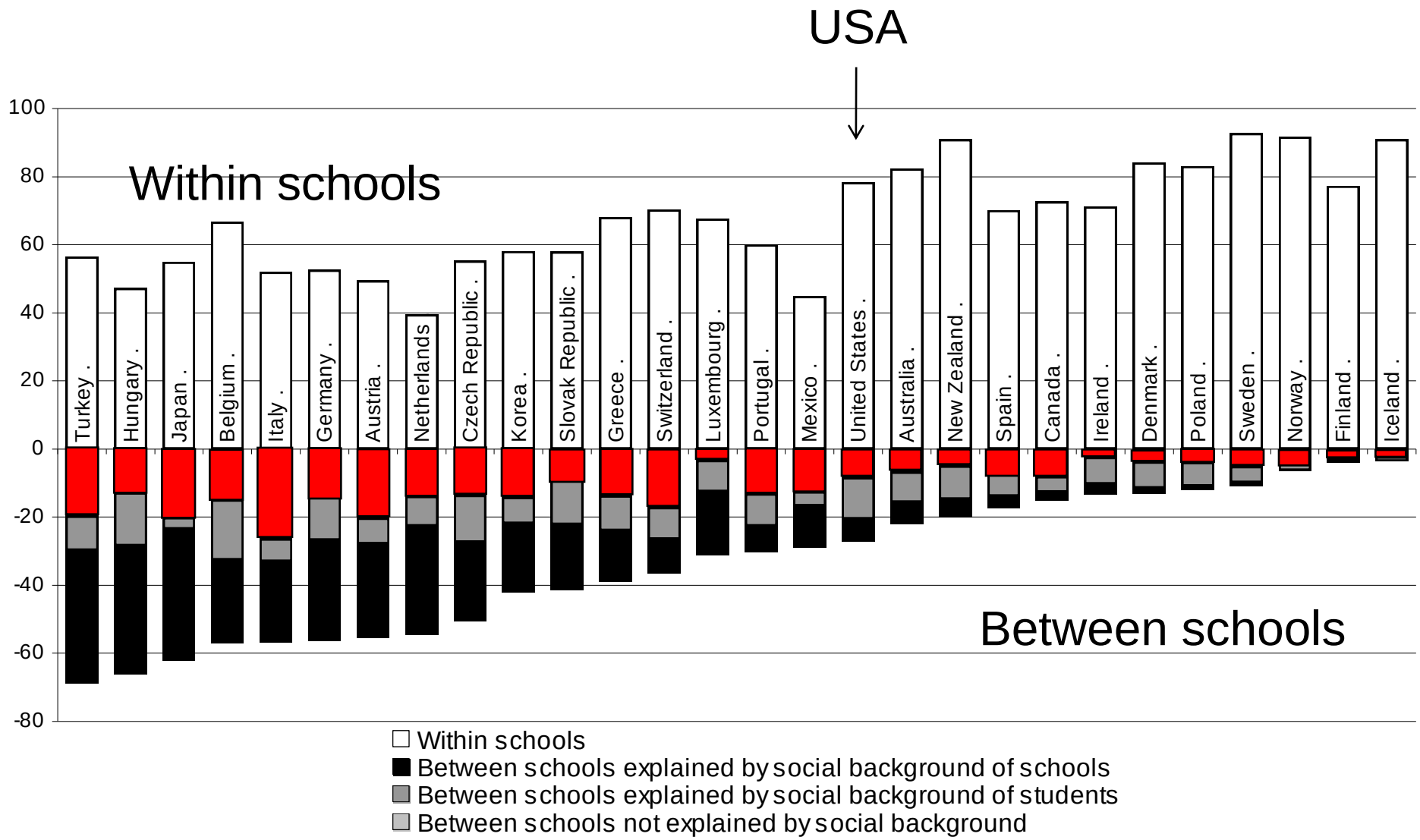
Within-school variation

Why do students get different results in school?

- Within class variation
  - Main cause: differences in students' abilities
- Between-class within-subject variation
  - Main cause: differences in teacher quality
- Between-subject, within-school variation
  - Main cause: differences in subject practice
- Between-school
  - Main cause: selection practices

As long as you go to school…

- It doesn't matter very much which school you go to
- But it matters very much which classrooms you are in…



OECD PISA data from McGaw, 2008

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Between school differences are small

In the USA

- 8% of the variability in attributable to the quality of education provided by the school, so
- 92% of the variability in the proportion achieving this is nothing to do with the school

So, if 15 students in a class reach proficiency in the average school:

- 17 students will do so at a “good” school (1sd above mean)
- 13 students will do so at a “bad” school (1sd below mean)

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Between-teacher differences are large

Take a group of 50 teachers

- Students taught by the most effective teacher in that group of 50 teachers learn in six months what those taught by the average teacher learn in a year
- Students taught by the least effective teacher in that group of 50 teachers will take two years to achieve the same learning (Hanushek, 2006)

And furthermore:

- In the classrooms of the most effective teachers, students from disadvantaged backgrounds learn at the same rate as those from advantaged backgrounds (Hamre & Pianta, 2005)

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Improving teacher quality takes time…

A classic labor force issue with 2 (non-exclusive) solutions

- Replace existing teachers with better ones
- Help existing teachers become even more effective

Replace existing teachers with better ones?

- Increasing the quality of entrants to exclude the lowest performing 30% of teachers would in result in one extra student passing a test per class every three years…

So we have to help the teachers we have improve

- The “love the one you’re with” strategy

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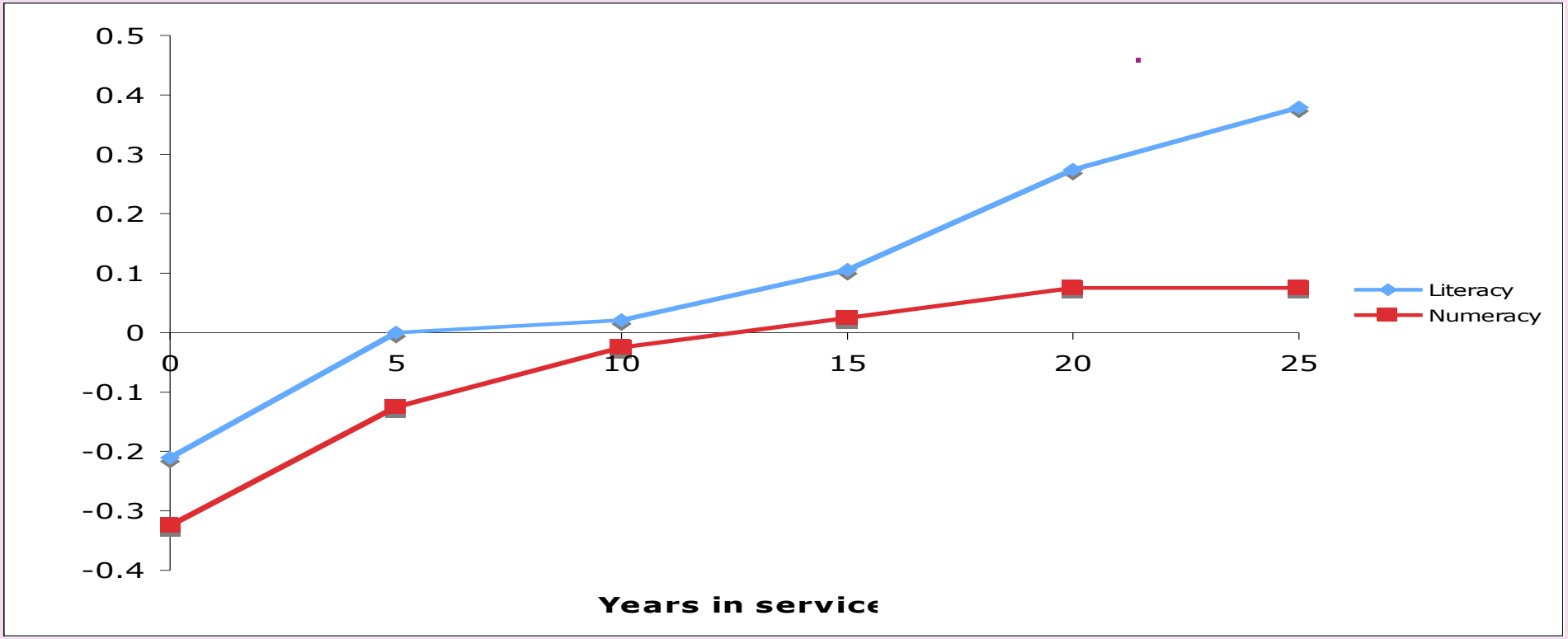
Teachers *do* improve, but slowly…



Leigh, A. (2007). Estimating teacher effectiveness from two-year changes in student test scores.

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Getting serious about professional development

Left to their own devices, teachers will improve, but slowly

- The average improvement in student value-added by a teacher over 20 years is **one-tenth** of the difference between a good teacher and a weak teacher on the first day of their teaching career.

Because we have been doing the wrong kind of professional development

- 100 “Baker days”
- Professional “updating”
- Recertification

Bigger improvements are possible

- Provided we focus rigorously on the things that matter
- Even when they’re hard to do

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Cost/effect comparisons

Intervention	Extra months of learning per year	Cost/classroom/yr
Class-size reduction (by 30%)	4	$30k
Increase teacher content knowledge from weak to strong	2	?
Formative assessment/ Assessment for learning	8	$3k

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Relevant studies

Fuchs & Fuchs (1986)
Natriello (1987)
Crooks (1988)
Banger-Drowns, et al. (1991)
Kluger & DeNisi (1996)
Black & Wiliam (1998)
Nyquist (2003)
Dempster (1991, 1992)
Elshout-Mohr (1994)
Brookhart (2004)
Allal & Lopez (2005)
Köller (2005)
Brookhart (2007)
Wiliam (2007)
Hattie & Timperley (2007)
Shute (2008)

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Formative assessment: a new definition

An assessment functions formatively to the extent that evidence about student achievement elicited by the assessment is interpreted and used to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions that would have been taken in the absence of that evidence. (Wiliam, 2009)

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The formative assessment hi-jack…

Long-cycle

- Span: across units, terms
- Length: four weeks to one year
- Impact: Student monitoring; curriculum alignment

Medium-cycle

- Span: within and between teaching units
- Length: one to four weeks
- Impact: Improved, student-involved, assessment; teacher cognition about learning

Short-cycle

- Span: within and between lessons
- Length:
  - day-by-day: 24 to 48 hours
  - minute-by-minute: 5 seconds to 2 hours
- Impact: classroom practice; student engagement

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Unpacking formative assessment

Key processes

- Establishing where the learners are in their learning
- Establishing where they are going
- Working out how to get there

Participants

- Teachers
- Peers
- Learners

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Aspects of formative assessment

	Where the learner is going	Where the learner is	How to get there
Teacher	**Clarify and share learning intentions**	**Engineering effective discussions, tasks and activities that elicit evidence of learning**	**Providing feedback that moves learners forward**
Peer	**Understand and share learning intentions**	**Activating students as learning resources for one another**	
Learner	**Understand learning intentions**	**Activating students as owners of their own learning**	

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Five “key strategies”…

Clarifying, understanding, and sharing learning intentions

⌘curriculum philosophy

Engineering effective classroom discussions, tasks and activities that elicit evidence of learning

⌘classroom discourse, interactive whole-class teaching

Providing feedback that moves learners forward

⌘ feedback

Activating students as learning resources for one another

⌘ collaborative learning, reciprocal teaching, peer-assessment

Activating students as owners of their own learning

⌘metacognition, motivation, interest, attribution, self-assessment

(Wiliam & Thompson, 2007)

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…and one big idea

Use evidence about learning to adapt instruction to meet student needs

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Keeping learning on track

A good teacher

- Establishes where the students are in their learning
- Identifies the learning destination
- Carefully plans a route
- Begins the learning journey
- Makes regular checks on progress on the way
- Makes adjustments to the course as conditions dictate

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Engineering effective discussions, activities, and classroom tasks that elicit evidence of learning

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Kinds of questions: Israel

Which fraction is the smallest? a) $\frac{1}{6}$, b) $\frac{2}{3}$, c) $\frac{1}{3}$, d) $\frac{1}{2}$.

Success rate 88%

Which fraction is the largest? a) $\frac{4}{5}$, b) $\frac{3}{4}$, c) $\frac{5}{8}$, d) $\frac{7}{10}$.

Success rate 46%; 39% chose (b)

[Vinner, PME conference, Lahti, Finland, 1997]

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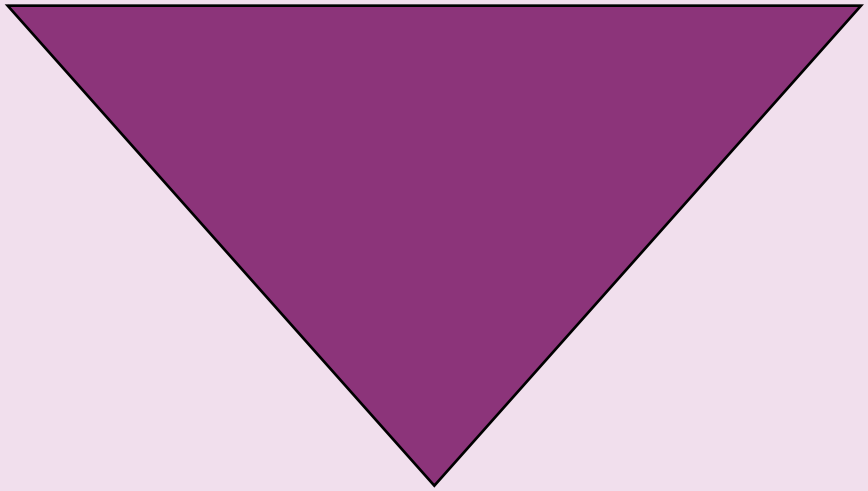
Draw an upside-down triangle…



Misconceptions

$$3a = 24$$

$$a + b = 16$$

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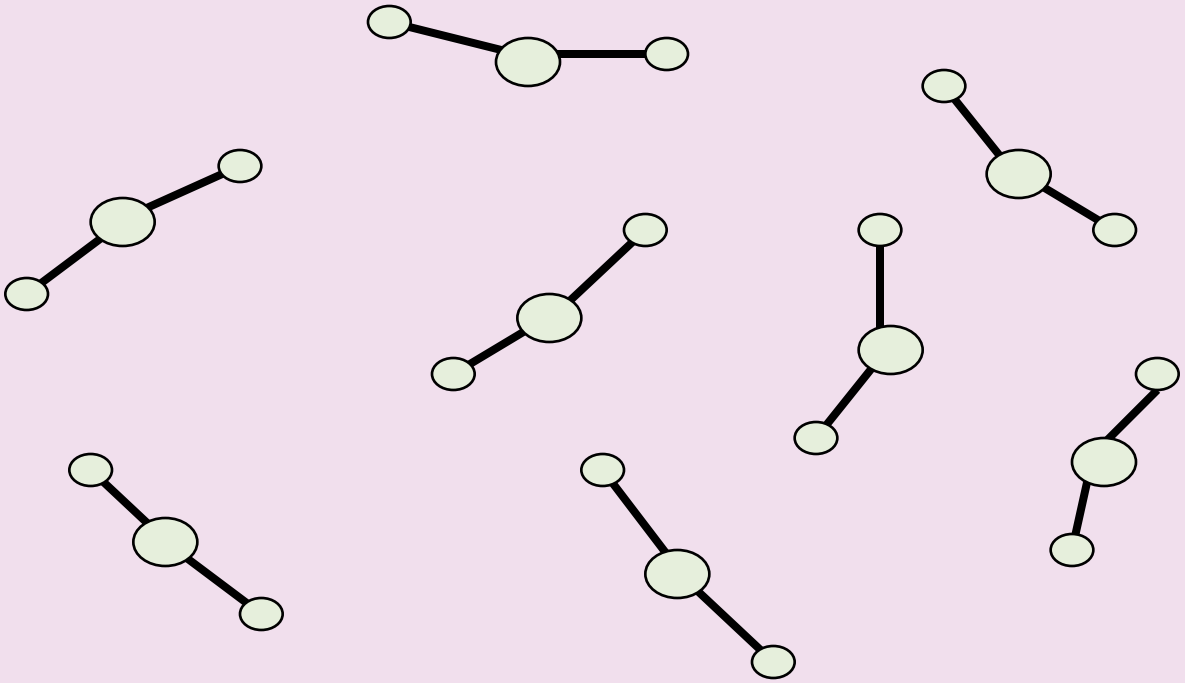
Molecular structure of water?



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Eliciting evidence

Key idea: questioning should

- ⌘ cause thinking
- ⌘ provide data that informs teaching

Improving teacher questioning

- ⌘ generating questions with colleagues
- ⌘ closed v open
- ⌘ low-order v high-order
- ⌘ appropriate wait-time

Getting away from I-R-E

- ⌘ basketball rather than serial table-tennis
- ⌘ ‘No hands up’ (except to ask a question)
- ⌘ ‘Hot Seat’ questioning

All-student response systems

- ⌘ ABCD cards, Mini white-boards, Exit passes

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Providing feedback that moves learners forward

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Kinds of feedback: Israel

264 low and high ability grade 6 students in 12 classes in 4 schools; analysis of 132 students at top and bottom of each class

Same teaching, same aims, same teachers, same classwork

Three kinds of feedback: scores, comments, scores+comments

	Achievement	Attitude
Scores	**no gain**	**High scorers: positive** **Low scorers: negative**
Comments	**30% gain**	**High scorers : positive** **Low scorers : positive**

[Butler(1988) *Br. J. Educ. Psychol.*, **58** 1-14]

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Responses

	Achievement	Attitude
Scores	**no gain**	**High scorers : positive** **Low scorers: negative**
Comments	**30% gain**	**High scorers : positive** **Low scorers : positive**

What do you think happened for the students given both scores and comments?

A. Gain: 30%; Attitude: all positive
B. Gain: 30%; Attitude: high scorers positive, low scorers negative
C. Gain: 0%; Attitude: all positive
D. Gain: 0%; Attitude: high scorers positive, low scorers negative
E. Something else

[Butler(1988) *Br. J. Educ. Psychol.*, **58** 1-14]

Kinds of feedback: Israel (2)

200 grade 5 and 6 Israeli students

Divergent thinking tasks

4 matched groups

- experimental group 1 (EG1); comments
- experimental group 2 (EG2); grades
- experimental group 3 (EG3); praise
- control group (CG); no feedback

Achievement

- EG1>(EG2≈EG3≈CG)

Ego-involvement

- (EG2≈EG3)>(EG1≈CG)

[Butler (1987) *J. Educ. Psychol.* **79** 474-482]

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Effects of feedback

Kluger & DeNisi (1996) review of 3000 research reports

Excluding those:

- without adequate controls
- with poor design
- with fewer than 10 participants
- where performance was not measured
- without details of effect sizes

left 131 reports, 607 effect sizes, involving 12652 individuals

On average, feedback increases achievement

- Effect sizes highly variable
- 38% (50 out of 131) of effect sizes were negative

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How do students make sense of this?

Attribution (Dweck, 2000)

- Personalization (internal v external)
- Permanence (stable v unstable)
- Essential that students attribute both failures and success to internal, unstable causes. (It's down to you, and you can do something about it.)

Views of 'ability'

- Fixed (IQ)
- Incremental (untapped potential)
- Essential that teachers inculcate in their students a view that 'ability' is incremental rather than fixed
  (by working, you're getting smarter)

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Practical techniques: feedback

Key idea: feedback should

- ⌘ cause thinking
- ⌘ provide guidance on how to improve

Comment-only grading

Focused grading

Explicit reference to rubrics

Suggestions on how to improve

- ⌘ Not giving complete solutions

Re-timing assessment

- ⌘ (eg three-fourths-of-the-way-through-a-unit test)

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Sharing learning intentions

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Practical techniques: sharing learning intentions

Explaining learning intentions at start of lesson/unit

- ⌘ Learning intentions
- ⌘ Success criteria

Intentions/criteria in students' language

Posters of key words to talk about learning

- ⌘ eg describe, explain, evaluate

Planning/writing frames

Annotated examples of different standards to 'flesh out' assessment rubrics (e.g. lab reports)

Opportunities for students to design their own tests

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Activating students as learning resources for one another and as owners of their own learning

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Students owning their learning and as learning resources

Students assessing their own/peers' work

- Daily sign-in
- Choose-swap-choose
- +/—/interesting
- Learning portfolio
- "Two stars and a wish"

Training students to pose questions/identifying group weaknesses

Self-assessment of understanding

- Traffic lights
- Red/green discs

End-of-lesson students' review

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Technique review

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Sustaining the adoption of formative assessment with teacher learning communities

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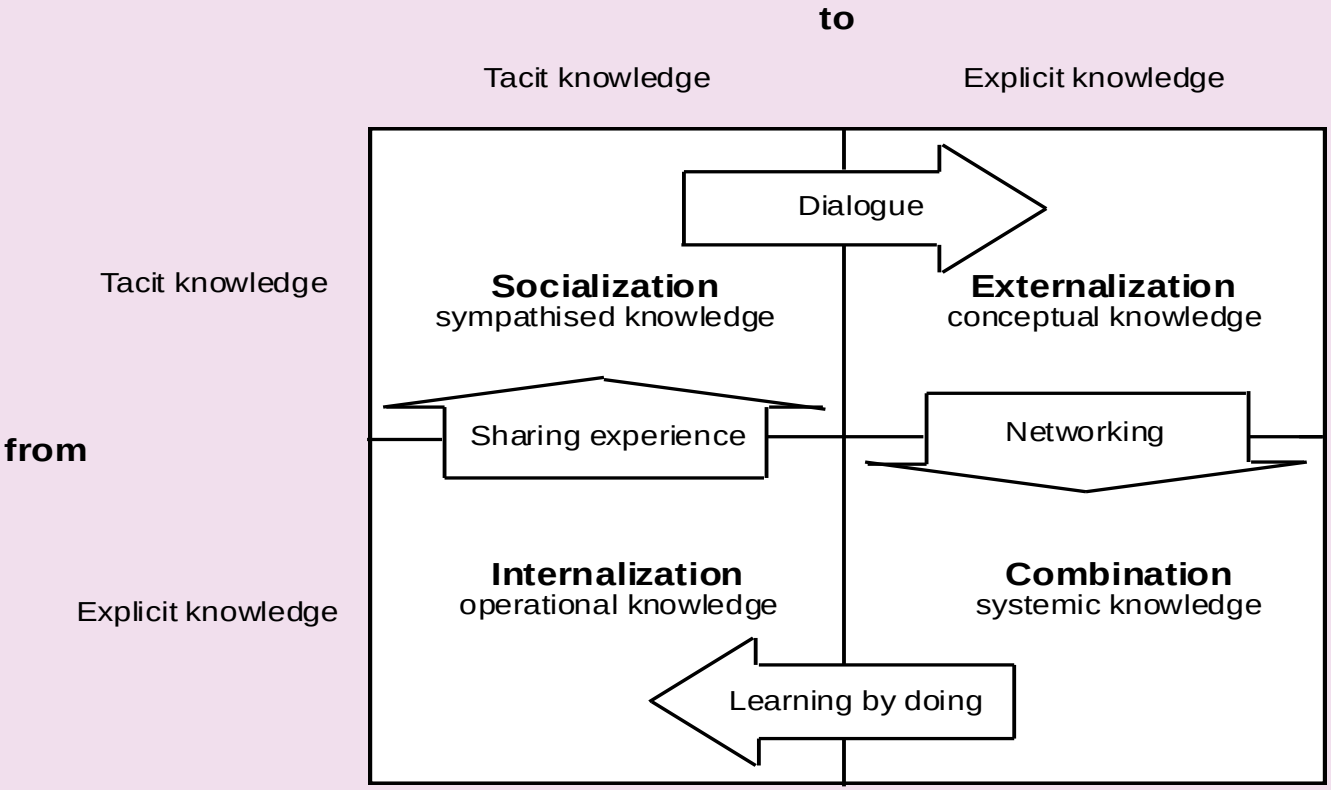
Knowledge ‘transfer’



After Nonaka & Takeuchi, 1995

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A model for teacher learning

Content, *then* process

Content (what we want teachers to change)

- Evidence
- Ideas (strategies and techniques)

Process (how to go about change)

- Choice
- Flexibility
- Small steps
- Accountability
- Support

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Choice

Belbin inventory (Management teams: why they succeed or fail)

- Eight team roles (defined as “A tendency to behave, contribute and interrelate with others in a particular way.”)
  - Company worker; Innovator; Shaper; Chairperson; Resource investigator; Monitor/evaluator; Completer/finisher; Team worker
- Key ideas
  - Each role has *strengths* **and** *allowable weaknesses*
  - People rarely sustain “out of role” behavior, especially under stress

Each teacher’s personal approach to teaching is similar

- Some teachers’ weaknesses require immediate attention
- For most, however, students benefit more by developing teachers’ *strengths*

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Flexibility

Distinction between strategies and techniques

- Strategies define the territory of formative assessment (no brainers)
- Teachers are responsible for choice of techniques
  - Allows for customization/ caters for local context
  - Creates ownership
  - Shares responsibility

Key requirements of techniques

- embodiment of deep cognitive/affective principles
- relevance
- feasibility
- acceptability

Small steps

According to Berliner (1994), experts

- excel mainly in their own domain.
- often develop automaticity for the repetitive operations that are needed to accomplish their goals.
- are more sensitive to the task demands and social situation when solving problems.
- are more opportunistic and flexible in their teaching than novices.
- represent problems in qualitatively different ways than novices.
- have fast and accurate pattern recognition capabilities. Novices cannot always make sense of what they experience.
- perceive meaningful patterns in the domain in which they are experienced.
- begin to solve problems slower but bring richer and more personal sources of information to bear on the problem that they are trying to solve.

Example: CPR (Klein & Klein, 1981)

Six video extracts of a person delivering cardio-pulmonary resuscitation (CPR)

- 5 of the video extracts are students
- 1 of the video extracts is an expert

Videos shown to three groups: students, experts, instructors

Success rate in identifying the expert:

- Experts: 90%
- Students: 50%
- Instructors: 30%

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Looking at the wrong knowledge…

The most powerful teacher knowledge is not explicit

- That's why telling teachers what to do doesn't work
- What we know is more than we can say
- And that is why most professional development has been relatively ineffective

Improving practice involves changing habits, not adding knowledge

- That's why it's hard
  - And the hardest bit is not getting new ideas into people's heads
  - It's getting the old one's out
- That's why it takes time

But it doesn't happen naturally

- If it did, the most experienced teachers would be the most productive, and that's not true (Hanushek, 2005)

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Sensory capacity (Nørretranders, 1998)

Sensory system	Total bandwidth (in bits/second)	Conscious bandwidth (in bits/second)
Eyes	10,000,000	40
Ears	100,000	30
Skin	1,000,000	5
Taste	1,000	1
Smell	100,000	1

Hand hygiene in hospitals (Pittet, 2001)

Study	Focus	Compliance rate
Preston, Larson & Stamm (1981)	Open ward	16%
	ICU	30%
Albert & Condie (1981)	ICU	28% to 41%
Larson (1983)	All wards	45%
Donowitz (1987)	Pediatric ICU	30%
Graham (1990)	ICU	32%
Dubbert (1990)	ICU	81%
Pettinger & Nettleman (1991)	Surgical ICU	51%
Larson et al. (1992)	Neonatal ICU	29%
Doebbeling et al. (1992)	ICU	40%
Zimakoff et al. (1992)	ICU	40%
Meengs et al. (1994)	ER (Casualty)	32%
Pittet, Mourouga & Perneger (1999)	All wards	48%
	ICU	36%

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We need to create time and space for teachers to reflect on their practice in a structured way, and to learn from mistakes
(Bransford, Brown & Cocking, 1999**)**

“Always make new mistakes”
Esther Dyson

“Ever tried. Ever failed. No matter. Try again. Fail again. Fail better.”
Samuel Beckett, *Worstward Ho*

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Support

Teacher learning is just like any other learning in a highly complex area

- In the same way that teachers cannot do the learning for their learners, leaders cannot do the learning for their teachers

What is needed from teachers

- A commitment to the continuous improvement of practice; and
- A focus on those things that make a difference to students

What is needed from leaders

- A commitment to engineer effective learning environments for teachers :
  - creating expectations for the continuous improvement of practice
  - keeping the focus on the things that make a difference to students
  - providing the time, space, dispensation and support for innovation
  - supporting risk-taking

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Making a commitment…

Action planning

- Forces teachers to make their ideas concrete and creates a record
- Makes the teacher accountable for doing what they promised
- Requires each teacher to focus on a small number of changes
- Requires the teacher to identify what they will give up or reduce

A good action plan

- Does not try to change everything at once
- Spells out specific changes in teaching practice
- Relates to the five “key strategies” of AfL
- Is achievable within a reasonable period of time
- Identifies something that the teacher will no longer do or will do less of

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…and being held to it

I think specifically what was helpful was the ridiculous NCR forms. I thought that was the dumbest thing, but I'm sitting with my friends and on the NCR form I write down what I am going to do next month.

Well, it turns out to be a sort of "I'm telling my friends I'm going to do this" and I really actually did it and it was because of that. It was because I wrote it down

I was surprised at how strong an incentive that was to do actually do something different … that idea of writing down what you are going to do and then because when they come by the next month you better take out that piece of paper and say"Did I do that?" … just the idea of sitting in a group, working out something, and making a commitment… I was impressed about how that actually made me do stuff. (Tim, Spruce Central High School)

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Comments?

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