

Enhancing Student Learning Achievement:

What works most effectively?

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A deduction, according to Flew's *Dictionary of Philosophy*, is a valid argument in which it is impossible to assert the premises and to deny the conclusion without thereby contradicting oneself. Deduction is the process of inference by reasoning from generals to particulars. It involves drawing a specific conclusion from general principles. The truth of a conclusion in a deductive explanation follows logically from a conjunction between laws, generalisations, or regularities, and initial conditions. Euclidean geometry proceeds by deduction from initial postulates and axioms. For example, if I know that a parallelogram is a quadrilateral with both pairs of opposite sides parallel, I can deduce from the conjunction of this generalisation with the observation of a figure in my Maths book, a plane figure with four straight sides and whose opposite sides are parallel, that it is a parallelogram. **Deduction**, in other words, proceeds *downwards* from a knowledge of general concepts and of prevailing conditions to a conclusion about a specific instance. By way of another example, if I know what the concept of a horse is, I can observe the features of this animal in front of me and deduce whether it is a horse, a donkey, or something else.

Imagine a child learning her mother tongue and its symbols and concepts. She may not yet have developed the concept of a horse, for example. In a journey through farming country a horse may be pointed out to her while she is told that it is a horse. She may assume that the word “horse” applies to all animals, and subsequently apply it to the next sheep or cow she sees. When corrected, she may still not know that the next animal she sees is a horse, because it is a different colour to the previous one identified for her. Gradually, she learns what distinguishes a horse from other animals, and what features of horses may vary from each other – hair colour, for example – in spite of their all being horses. Gradually, she *induces* the concept of ‘horseness’: her mind works *upwards* from the concreteness of examples to the abstraction of the concept or principle. This is the process of **induction**, and involves, in essence, the development of a general concept or principle from repeated observation of examples. It is the process of inferring a principle or general law from the empirical observation of particular instances.

Inductive and Deductive Approaches to Learning

Notice that the second paragraph, explaining induction, is much easier to read and understand. That's because it's written inductively:

It proceeds from a concrete example with which we can all identify from our own familiarity with childhood, upwards to a general statement and definition of the term.

The first paragraph, explaining deduction, is less easy to read and understand – because it's written deductively:

It starts with an abstract definition of the concept taken from the discourse of philosophy and, using the language of that discourse, works downwards to the provision of concrete examples, only the last of which is familiar to everybody.

How do children learn?

Children (and adults) learn best by learning inductively

What happens inside the 'black box' in the brain when learning takes place, or, how do we learn better?

1. The inductive connection of the new to what is already known

Learning depends on and builds on prior knowledge, on what is already known

“You can’t teach somebody something that they don’t already know”

2. The activation of one’s “apperceptive framework”

Apperception: the process of understanding something newly perceived in terms of previous experience

3. Motivation: the meaning, the value, the interest that the child places in the new knowledge

The child therefore has to be ready to learn something: sufficiently mature, and sufficiently motivated

John BRANSFORD, Ann BROWN & Rodney COCKING (Eds.) (2000) *How People Learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Helping children to learn better

Designing tasks and a learning environment that encourage students to engage actively, to reflect, to make meaning: thus, learning needs to be *situated and contextualized within what the child already knows*.

Developing students' learning strategies and meta-cognitive skills (thinking about thinking):

- the activation of one's "apperceptive framework"
- by identifying one's purpose in reading / learning it (look at it through particular lenses), thus
- connecting what is new to what is already known.

Young children will do this naturally in an appropriately structured learning environment;

Older children can be taught to employ these meta-cognitive strategies consciously.

Enhancing student's motivation, and the motivational context, enhances learning:

- Is the learning perceived as meaningful, worthwhile, interesting, of value, to the learner?
- Does the learner have a purpose in learning it?

Note the importance of motivational feedback and reinforcement.

Providing corrective feedback continually through continuous assessment of where each learner is in her understanding.

- Where am I?
- Where to next?
- How do we get there?

This is the meaning of genuinely worthwhile formative assessment: it is the bridge between teaching and learning, without which the two are not easily connected.

- **What (kinds of) factors influence school student learning?**
- **Which factors have the most powerful effect on school student learning?**
- **What can teachers do to enhance school student learning most effectively?**

The critically important role of teachers

Teacher effects are much greater than school effects:

Improving schools means improving teachers, rather than focusing on the structure of schooling.

"The quality of a country's education system cannot exceed the quality of its teachers."

Michael Barber, McKinsey Report (2007)

"Teachers are everything. Our policies must be teacher-centred."

Betty Mould-Idrissu, Minister of Education, Ghana
(December 2011)

The critically important role of teachers (ctd)

In the classrooms of the best teachers, students learn at twice the rate that they do in the classrooms of average teachers:

- they learn in six months what students taught by the average teachers take a year to learn.
- And in the classrooms of the least effective teachers, the same learning will take two years.

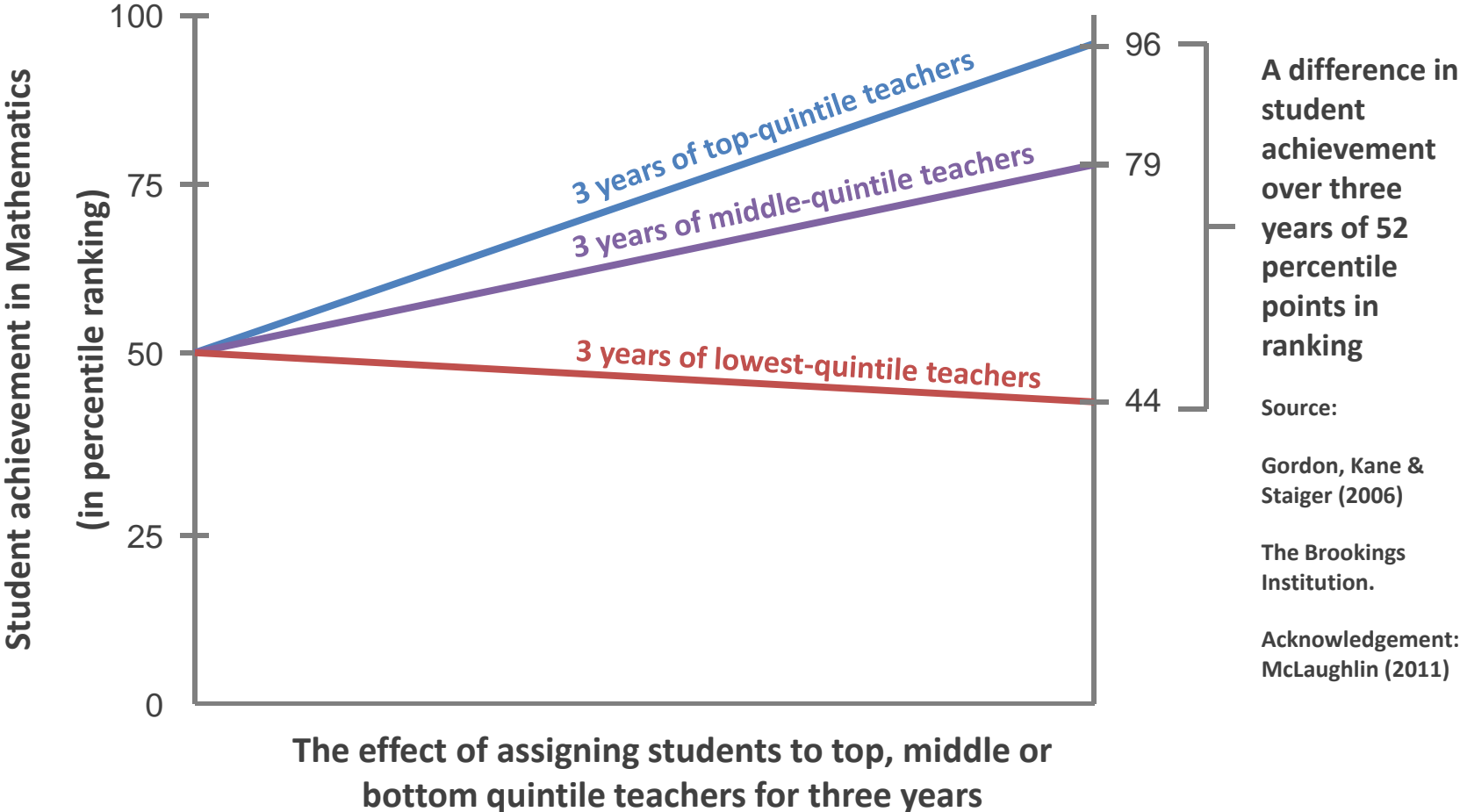
Moreover, in the classrooms of the most effective teachers:

- students from disadvantaged backgrounds learn just as much as those from advantaged backgrounds; and
- those with behavioural difficulties learn just as much as those without.

Dylan WILIAM (2011) *How do we prepare students for a world we cannot imagine?* Paper presented at the Salzburg Seminar, Optimizing Talent: Closing Educational and Social Mobility Gaps Worldwide, 6-11 December 2011. Salzburg, Austria.

The effect of teachers on student learning achievement

Teacher effects over time



Mark MASON (1999) Outcomes-based Education in South African Curricular Reform.
Cambridge Journal of Education, 29 (1), 137-143.

“The best teachers will seek a thoughtful integration of propositional, procedural and dispositional knowledge in their classrooms” (p. 143).

Propositional, Procedural, and Dispositional knowledge

See Gilbert RYLE:

- *Learning ‘that’ and learning ‘how’, and*
- *The difference between knowing ‘that’ and knowing ‘how’*

Propositional knowledge:

“I know **that** Apartheid was a system designed to perpetuate White rule in South Africa.”
(Knowledge *that*)

Procedural knowledge:

“I know **how** one uses evidence in support of an argument to write a History essay.”
(Knowledge *how*)

Dispositional knowledge:

“I know **to** respect the value of human rights for all people, irrespective of their race or religion.”
(Knowledge *to*)

Mark MASON (2000) Teachers as Critical Mediators of Knowledge. *Journal of Philosophy of Education*, 34 (2), 343-52.

“Teachers as actively mediating between what is known and what is not yet known by the learner.” (p. 348)

“Likewise, teachers as socio-cultural critics are responsible for making the culture, worldview, social arrangements, and everyday practices of their society more accessible to their students. This would mean raising a lot of what they assume as normal or natural to the level of conscious critical analysis and assessment – by asking questions about how they view the world, about those arrangements and practices that they take for granted.” (p. 349)

How do we improve teacher quality?

In countries such as Finland, Japan and Singapore, one strategy involves highly selective recruitment into the profession: this is possible because of the high status of teachers in those countries.

For other countries, long-term strategies to raise the status of the profession are important, but the consequent effects on learning will take decades to realize.

"For example, suppose we could immediately raise the threshold for entry into teaching so that from now on, only those who are better than the lowest-performing one-third of current entrants were able to become teachers.

Suppose further that despite this raising of the threshold for entry into the profession, we were still able to recruit as many teachers as we needed.

The effect of this - eventually - would be to increase teacher quality by just 20% of the current gap between teacher quality in Finland and average performing countries such as the USA or the UK.

This would be equivalent to raising PISA scores by just 5 percentage points - in 30 years' time."

Should we replace poor teachers with better ones?

Should we give better teachers performance bonuses?

Trying to improve teacher quality by **replacing poor teachers** with new teachers of higher quality will take time and resources, and the impact will be felt only years hence.

Eric Hanushek has shown that if the lowest performing teachers could be replaced by average teachers every year, it would take 30 years for this strategy to have an impact on teacher quality.

And the net impact would probably be in the order of just two percentage points on PISA.

Teacher performance incentives are frequently not correlated with improved teacher performance; and

they are difficult to implement fairly:

because the effects of good teachers benefit their students for at least three years after they've ceased to teach them.

Changing and improving the practice of existing teachers will probably be the most effective strategy

But, the focus of professional development should not primarily be on enhancing teachers' disciplinary content knowledge:

while it is essential, teacher subject knowledge is only a small part of teacher quality - possibly as little as 10% in primary schools, and no more than 30% in secondary schools.

More important is changing teachers' *pedagogical content knowledge*, and

changing what they do in classrooms.

It is about continual professional development focused on the continuous improvement of teachers' classroom practice.

Changing and improving teacher practice

To help teachers change what they do in classrooms, they need

- the flexibility and the professional autonomy to exercise their judgement in adopting ideas that suit their personal style;
- to take small but continuous steps in changing their practice;
- to be supported in their efforts to change their practice; and
- to be accountable for improving their practice.

Note Hattie's findings indicating the considerable effect-size of teacher innovations:

It seems that, perhaps because of the enthusiasm of the teacher who is constantly trying to improve her practice, or because of the student's excitement at experiencing something innovative, the simple act of trying some innovation, some new strategy (that must of course be deliberately aimed at improving learning), tends to have positive effects on student learning and achievement.

How do we do this?

Through the establishment of teacher-learning communities in schools, where teachers support each other in the development of their classroom practice.

The importance of the school principal's leadership in creating a culture of and the space for continuous professional development, and in motivating teachers' commitment to improve (the principal as the *lead learner* in the school):

- What are you going to try to improve in your practice this year?
- How are you going to do it?
- What evidence of its effect on learning outcomes will you show?

Among the most important strategies that teachers can aim to develop is that of ***using formative assessment as assessment for learning***.

Assessment as the bridge between teaching and learning

Importantly, this does not mean that teachers should be making students write tests every other day.

Effective feedback, according to Hattie, 'means providing information how and why the child understands and misunderstands, and what directions the student must take to improve'. It implies that the best teacher will make every effort to assess and evaluate her students' understanding, in order that she might understand the constructions her students have made in their learning, so that she might then match her next teaching act to this understanding.

The most successful feedback will seek to correct erroneous hypotheses that students might have made, and will be linked to reinforcement aimed at further motivating the student.

'If we, as teachers, are to have an impact on learning', says Hattie, 'then we must come to know what our students are thinking so that we can provide more feedback ... and develop deep understanding'.

John HATTIE (2009) *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement*. London & New York: Routledge.

(Over 800 meta-analyses; 15 years' research and synthesis of over 50,000 studies; effect-size in standard deviations; sample size of millions of students; more than 146,000 factors; average effect-size 0.40 standard deviations)

Hattie concluded that 'most innovations that are introduced in schools improve achievement by about 0.40 of a standard deviation'. He thus used an improvement of 0.40 standard deviations as the standard by which to judge the size of learning effects.

Note that Hattie's research does not take much account of the Socio-Economic Status [SES] of the families from which children come; of family resources; of poverty; of health, nutrition, etc.

Hattie vs Carnoy: SES accounting for approximately 50% of the variance in learning outcomes?

Note the importance of feedback, goal-setting, and what the teacher actually does.

Feedback is informational (correcting the learner's inappropriate construction in $a^2 \times a^3 = a^6$) and motivational.

In the largest meta-analysis (a study of other studies) of the factors that have been shown to enhance learning most effectively, John Hattie (formerly, University of Auckland) found the following:

Effect-sizes of selected factors that enhance learning most effectively (Hattie, 2009)

Teacher provision of formative evaluation	0.90
Classroom behavioural factors	0.80
Teacher clarity	0.75
Feedback	0.73
Teacher-student relationships	0.72
Meta-cognitive strategies	0.69
Student prior achievement	0.67
Teacher professional development	0.62
Teaching strategies	0.60
Direct instruction	0.59
Home environment	0.57
Home socio-economic status	0.57
Teacher setting of goals	0.56
Peer-tutoring	0.55
Classroom management	0.52
Teaching with interactive video	0.52
Parental involvement	0.51
Small group learning	0.49
Student concentration/persistence/engagement	0.48
Student motivation	0.48
Early intervention	0.47
Teacher questioning	0.46
Mathematics curricula	0.45
Pre-school programmes	0.45
Quality of teaching	0.44
Writing programmes	0.44
Teacher expectations	0.43
Student self-concept	0.43
Science curricula	0.40

Effect-sizes of selected factors that enhance learning most effectively (Hattie, 2009)

Integrated curriculum programmes	0.39
Time on task	0.38
Computer-assisted instruction	0.37
Principals / school leaders	0.36
Inductive teaching	0.33
Class size	0.21
Problem-based learning	0.15
Ability-grouping / streaming	0.12
School retention ('failed' students repeating)	- 0.16
Television watching at home	- 0.18

The importance of teachers providing feedback on their learning to students

The 'simplest prescription for improving education' according to Hattie, is 'dollops of feedback'. Effective feedback 'means providing information how and why the child understands and misunderstands, and what directions the student must take to improve'.

It implies that the best teacher will make every effort to assess and evaluate her students' understanding, in order that she might understand the constructions her students have made in their learning, so that she might then match her next teaching act to this understanding.

The most successful feedback will seek to correct erroneous hypotheses that students might have made, and will be linked to reinforcement aimed at further motivating the student.

'If we, as teachers, are to have an impact on learning', says Hattie, 'then we must come to know what our students are thinking so that we can provide more feedback ... and develop deep understanding'.

Thus, teachers who understand their discipline well, and who care about their students and what they know, will be better able to set challenging goals and to provide well directed feedback.

The importance of setting learning goals

After feedback, among the next most powerful factors that enhance learning achievement are teacher strategies involving the setting of specific and challenging learning goals for students.

According to Hattie, appropriate, challenging, and specific goals inform individuals 'as to what type or level of performance is to be attained so that they can direct and evaluate their actions and efforts accordingly. Feedback allows them to set reasonable goals and to track their performance in relation to their goals so that adjustments in effort, direction, and even strategy can be made as needed'.

Learning goals:

- Direct attention to relevant tasks or outcomes;
- Energise task performance;
- Motivate individuals to persist in their activities through time;
- Convey normative information by suggesting or specifying what level of performance the student could be expected to attain; and,
- Have dramatic effects on the development of self-efficacy, which in turn affects the choice of difficulty of goals.

Hattie reminds us that 'feedback without goal setting is less effective, and goal setting without feedback is ineffective. A combination of goal setting and feedback is most effective. ... The greater the challenge, the higher the probability of the student seeking, receiving, and assimilating feedback information'.

Do structural innovations serve to enhance learning?

Most structural innovations aimed at improving learning, such as financial resources, physical attributes such as the quality of facilities, school policies, streaming according to ability groups, and the like, do not have a sizeable effect on student learning.

If such structural innovations do work, it is through the core effects of feedback, goal-setting, and actual teaching.

There is, for example, a linear relationship between class size and achievement from the hundreds down to classes of about 25; but it is only when class size gets smaller than about 15 that exponential increases in achievement result.

The conclusion to draw from this change in the relationship from linear to exponential is that smaller class sizes in and of themselves do not necessarily produce better results: very much smaller classes obviously make it much more possible for teachers to provide more and better quality feedback, which is what improves learning.

The factor class size is mediated through the factor feedback.

This is likely to be the case for other factors such as introducing computers into the classroom, prescribing more homework, managing the classroom more effectively, etc: they offer more opportunities for more feedback, but do not guarantee that it will occur. The teacher who is most effective at enhancing learning will exploit every opportunity to provide more feedback.

Alexa TODD & Mark MASON (2005) Enhancing Learning in South African Schools: Strategies beyond Outcomes-Based Education. *International Journal of Educational Development*, 25 (3), 221-35.

Fullan offers three reasons why innovations are “difficult to disseminate and replicate” (1999: 63).

The first is that “the *products* of other people’s reform efforts hide many of the subtleties of the reform in practice” (ibid.). This is best understood in terms of Schön’s analogy of the iceberg, cited by Fullan, where the bulk of “tacit knowledge and artistry beneath the surface of readily accessible descriptions” often remains elusive to policy makers seeking to transfer good practice from elsewhere into their own context.

Fullan’s second reason for the difficulty of transferability of successful innovations is that “successful reforms in one place are partly a function of good ideas, and largely a function of the conditions under which the ideas flourished” (ibid.: 64). He suggests that “successful innovations ... fail to be replicated because the wrong thing is being replicated – the reform itself, instead of the conditions which spawned its success” (ibid.). The facts, then, that the tacit knowledge underlying successful innovation is often unable to be tapped, and that the conditions premising it are unable to be replicated,

lead to his third reason, offered by way of a conclusion: that **“reform on a large scale depends on the development of local capacity to manage multiple innovations simultaneously” (ibid.: 65). “The development of local capacity, thousands of times over, is therefore the ultimate complex problem because *each* local situation to a certain extent will be unique and will need to develop differently depending on the particular configuration of its evolution” (ibid.: 66).** Better support for the importance of in-service teacher education would be hard to find.

TODD & MASON, p. 234.

Pre-service and in-service teacher education should focus on the following:

In order that teachers might

- set appropriate, challenging, and specific *learning goals* for their students,
 - provide lots of *feedback* that is appropriate to students' current levels of understanding, and
 - offer plenty of *reinforcement* to motivate their students to achieve their learning goals,
- they should
- understand and appreciate the importance of setting *learning goals*, providing *feedback*, and offering *reinforcement* to their students, and
 - develop
 - their knowledge of their *disciplinary curriculum*, and
 - their skills in *assessing students' current levels of understanding* to these ends, as well as
 - their skills of *classroom management*,
 - their pedagogical skills of *actual teaching*, and
 - their *sense of self-efficacy, enthusiasm and motivation* so that they may in turn, in a positive spirit,
 - reinforce their *students' motivation*, and
 - constantly and energetically seek ways for *innovation* in their practice,
 - by continual *reflection* on what they are doing to improve learning,
 - through *in-service education* and otherwise,

so that they can

- provide a better *quality of teaching*,
- *effectively manage* their classrooms to maximize the *quantity of teaching*,
- do lots of *direct teaching*,
- adopt a *teaching style*, that includes *questioning*, and provides feedback on *homework* set according to learning goals, oriented to learning, and,
- establish a *classroom environment*, that includes *peer tutoring*, oriented to learning.

Pre- and in-service teacher education focused on these skills and dispositions, and on the associated knowledge, is what will enjoy most success and prove most effective in the enhancement of student learning.