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EXPANSIVE EDUCATION NETWORK Research digest
Learnable Intelligence

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Happily for teachers, teaching for intelligence, and covering material required by the curriculum need not be conflicting endeavours..

Message from the team

The 'nature or nurture' question has long interested educationalists. Can children get smarter? Or are they stuck with whatever intelligence they inherit from their parents.

This issue is at the heart of our thinking in the Expansive Education Network and we believe that there is compelling evidence for the learnability of much of what we currently refer to with the term 'intelligence'. Indeed the emerging science relating to this topic is one of four dimensions of the way we use the word 'expansive'. Readers please accept this declaration of our position and read what follows with appropriate open-mindedness!

We are by no means alone in our thinking about the learnability of intelligence. The former president of the American Educational Research Association, Lauren Resnick, describes intelligence as "the sum of one's habits of mind." (1999). Intelligence, she suggests, can be thought of as comprising an orchestra of skills and attitudes brought to bear at the appropriate time in order to meet the challenges of life. In this sense it is a matter of common sense that we can all get more intelligent.

Undoubtedly there is a part of intelligence that is predisposed by genetics in each of us, and our temperament is also inbuilt to a degree. Yet just as any habit can be developed, so habits of mind such as self-discipline and resilience can be taught and learned. And these habits of mind (or dispositions) are just as likely – if not more so - to be indicators of exam success than IQ (Angela Duckworth and Martin Seligman, 2005). Learning dispositions also develop through experience – either positively, or negatively – and so the aspect of intelligence determined dispositionally is, to a large degree, learnable. Exactly the size of this 'large degree' is debatable. But the message to educators is positive: you CAN influence the academic chances of those you teach.

Increasingly, approaches that focus on the so-called fixed 'ability' of students are being replaced by those that focus on the expandability of intelligence. Research in the US by Carol Dweck has demonstrated that those children who believe they can get smarter actually do so.

Without that belief that mental capacity can grow, there would be little point focusing on developing learning dispositions and 'habits of mind'. It would not make sense to try to cultivate deliberate practice, risk taking, and creativity.

In this issue we show how the debate about intelligence has moved beyond testing. We explore some of the recent and current research, and ask what this means for teachers.

Bill Lucas, Ellen Spencer and Janet Hanson

Angela Duckworth and Martin Seligman (2005) Self-Discipline Outdoes IQ in Predicting Academic Performance of Adolescents. *Psychological Science.* 16(2):939-44

Lauren Resnick (1999) Making America Smarter. *Education Week Century Series.* 18(40): 38-40
http://ifl.lrdc.pitt.edu/index.php/download/index/mas

What is intelligence?

What makes us intelligent? Is intelligence innate and fixed, awaiting a good teacher to unlock each pupil's predestined store of 'smarts'. Or – and this might be the preferred wish of many teachers – can any child be expected to achieve great things given the right encouragement and training? Or is the reality a more complex mix of nature and nurture?

There is broadly a consensus of opinion among experts about the nature, origins, and practical consequences of individual and group differences in intelligence. In a 1994 editorial for *The Wall Street Journal,* Linda Gottfredson outlined 25 mainstream expert conclusions as a response to media commentators misrepresenting scientific information. In particular, Richard Herrnstein and Charles Murray's 1994 publication *The Bell Curve* was widely reported to have argued that racial differences in intelligence are genetic. The authors stated quite clearly, however, that differences were attributable to both genes and the environment. Indeed, the nature and practical applications of the IQ concept are widely misunderstood by the public, according to Mark Snyderman and Stanley Rothman in their book *The IQ Controversy*.

Intelligence is broadly a general mental capability. Referencing Sternberg and Detterman's 1986 publication *What is Intelligence?*[1] Mark Snyderman and Stanley Rothman note that "the most frequently cited elements of intelligence [by experts in the field] are higher-level cognitive functions, such as abstract reasoning and problem solving". Among other things it involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and to learn from experience. Gottfredson further says: "it is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings – 'catching on', 'making sense' of things, or 'figuring out' what to do."

Much like the related concept of creativity, however, exactly what intelligence comprises and how these dimensions might interrelate is debated[2]. Questions remain in three areas, although these do not necessarily reflect areas of contention, just unknowns:

1. The extent to which the **origins** of intelligence are genetically predetermined, or environmentally determined;
2. Its nature as a **general ability** or as a set of – or integration of – a number of "distinct abilities which independently frame academic performance in different domains of knowledge and learning" (Adey and colleagues, 2007. p78).
3. The extent to which it is stable (fixed) or malleable (**learnable**).

Beginning with its **origins**: according to the authors of *The IQ Controversy*, the word 'intelligence' is said to have originated in the Latin but to have been brought into use in the middle of the 1800s as a scientific term meaning "innate, general cognitive ability". Despite this statement's implicit support for the role of 'nature', we know that human intelligence is affected by both genes and the environment (Mackintosh, 2014). Mark Snyderman and Stanley Rothman (1990) illustrate this with a quote from Donald Hebb: "To ask how much heredity contributes to

[1] This publication covered the 1921 *Journal of Educational Psychology* symposium, in which 25 intelligence experts responded to the question: "what is intelligence?". The most frequently cited elements of intelligence were mentioned by at least half the contributors.

[2] On what it means to be creative, see for example Ellen Spencer, Bill Lucas and Guy Claxton (2012) *Progression in Creativity – Developing New Forms of Assessment: A literature review*. Newcastle Upon Tyne: Creativity, Culture and Education www.creativityculturereducation.org/category/literature-reviews

intelligence is like asking how much the width of a field contributes to its area" (p79). They argue that both aspects are important, and neither can be assigned more significance than the other. While the 'nurture' element would appear to be of more interest to educators and learners, Kathryn Asbury and Robert Plomin's work aims to show how a dialogue between geneticists and educationalists can be of benefit to education.

Although the idea of intelligence as a **general ability** that functions across all contexts and domains is widely supported, the idea of autonomous 'multiple intelligences' is very popular among educators. Howard Gardner's multiple intelligence theory suggests there are several forms of intelligence, as well as the more accepted definitions. Philip Adey and colleagues argue that its popularity is in part a reactionary response against high profile advocators of the idea of intelligence as largely inherited.

One of several key contemporary thinkers on intelligence was JP Guilford (1897-1987). A psychologist by profession, Guilford focused his efforts on the study of individual difference. He believed that intelligence was not confined to a single, universal attribute, but that it comprised a combination of a number of relatively independent multiple abilities. He was particularly averse to the idea of intelligence testing because of its inability to focus on an important aspect of intelligence: creativity. Through mathematical factor analysis, Guilford and his colleagues identified twenty-five important mental ability factors.

And lastly, its 'plasticity'. According to Linda Gottfredson's mainstream statement about intelligence (1994), no one claims that individuals are born with fixed, unchangeable levels of intelligence. Intelligence is **learnable,** and given the right conditions it can be expanded. Building Learning Power talks of the brain (the seat of intelligence) as a 'muscle' which, like any muscle, is strengthened and toned with use. Quality coaching, the right kinds of practice, optimum levels of exertion, and adequate periods of rest, can foster development in intelligent decision-making, problem-solving, and interpersonal interactions, just as they can strengthen and grow muscle groups and athletic skill.

Alfred Binet (1857-1911), most commonly known as the father of the IQ concept, clearly believed strongly in the plasticity of intelligence:

> Some recent philosophers have given their moral approval to the deplorable verdict that an individual's intelligence is a fixed quantity, one which cannot be augmented. We must protest and act against this brutal pessimism… it has no foundation whatsoever… What [slow learners] should first learn is not the subjects ordinarily taught, however important they may be; they should be given lessons of will, of attention, of discipline; before exercises in grammar, they need to be exercised in mental orthopaedics; in a word they must learn how to learn. (1909)

In *Outsmarting IQ: The emerging science of learnable intelligence,* David Perkins (1995) proposed three mechanisms that underlie intelligence, and these respond fairly well to each of the three areas we have just looked at:

1. Neural intelligence: the "genetically determined, hard-wired original equipment" each person inherits which determine how fast and efficiently their brain processes. Little impact can be made upon this.
2. Experiential intelligence: the context-specific knowledge built up over time, which can be expanded.
3. Reflective intelligence: the "good use of mind: the artful deployment of our faculties of thinking", which includes self-monitoring. Perkins refers to this capacity as 'mindware', which, again, can be expanded.

Ideas about learnable intelligence give credence to the idea that children can be assisted to develop along a trajectory of increased intelligence throughout their time in education. As Philip Adey and colleagues point out:

> "[i]f we know that we can help our students throughout their formal schooling period continually to raise their ability to process information – any sort of information – then surely this must be what we should be striving for."

Bill and Guy's *New Kinds of Smart* brought to light the multifaceted nature of intelligence. As well as being expandable, intelligence is:

- 'composite', comprising an orchestra of skills and attitudes;
- 'practical', residing in the body and expressed as muscle memory, dexterity, coordination and manual skill, rather than the narrow view of intelligence as abstract reasoning;
- 'intuitive', and so frequently cannot be expressed verbally as a logical thought process;
- 'distributed', developing as individuals link together and others and learn to be discerning with information through tools and resources.
- 'social', as individuals work collectively as a problem-solving unit.
- 'strategic' and reflective, involving 'transfer' and the use of knowledge and experience.
- 'ethical', making value judgments in a world of complexity and choices.

The idea that intelligence is learnable is one to which we return.

Alfred Binet (1909) *Les Idées Modernes sur les Enfants.* Paris: Flammarion

Angela Duckworth and Stephanie Carlson (in press). Self-regulation and school success. In B.W. Sokol, F.M.E. Grouzet, & U. Müller (Eds.), *Self-regulation and autonomy: Social and developmental dimensions of human conduct*. New York: Cambridge University Press

Bill Lucas and Guy Claxton (2010) *New Kinds of Smart.* Berkshire: Open University Press

David Perkins (1995) *Outsmarting IQ: The emerging science of learnable intelligence.* New York: Free Press

Howard Gardner (1993) *Frames of Mind: The Theory of Multiple Intelligences*. London: Fontana Press

Mark Snyderman and Stanley Rothman (1990) *The IQ Controversy: The media and public policy.* New Jersey: Transaction Publishers

Nicholas Mackintosh (2014) Why Teach Intelligence? *Intelligence*. 42: 166-170

Philip Adey, Benõ Csapõ, Andreas Demetriou, Jarkko Hautamäki, and Michael Shayer (2007) Can We Be Intelligent About Intelligence? Why education needs the concept of plastic general ability. *Educational Research Review* 2: 75-97

Richard Herrnstein and Charles Murray's (1994) *The Bell Curve: Intelligence and class structure in American Life.* New York: Free Press

Kathryn Asbury and Robert Plomin (2013) *G Is For Genes: The impact of genetics on education and achievement.* Chichester: John Wiley & Sons Ltd.

Why I.Q. is not enough

How does the idea of intelligence testing relate to expandable intelligence?

Originally designed to identify school children in need of special help, the well-known concept of IQ score conceived by Alfred Binet has been synonymous with intelligence for the greater part of the last century, and remains ubiquitous in the public consciousness. It was never meant to be used as a general device for ranking all pupils according to mental worth. And yet it somehow assumed an importance far out of proportion with its actual value. It is still used by psychologists to assess children for special education, 'gifted and talented' provision, admission to college and employment. Since 1945 it has been used in the eleven plus exam, which is still used in selective schools today.

In the middle of the last century, liberals influencing policy (in the U.S. in particular) saw intelligence tests as significant in the move for social progress. Through 'objective' testing, a meritocracy would replace notions of 'character' and 'right connections'. In theory this would open doors – to higher education for instance – to groups previously excluded. Testing would help ensure people were placed in suitable jobs, as well as given remedial help in schools, should tests identify them as being in need. Conservatives, however, saw the move as an erosion of traditional values, while radicals saw it as a violation of equality.

Although Binet himself never intended for IQ to be such a linear measure – but rather believed it should encompass a broad range of measures – its popularity as a shorthand for intelligence is a legacy that is hard to shake off. Perhaps with good reason, because it is yet to be replaced with a more convincing measure, if one is required – and quantitative ranking of individuals prevails across societies. As well, there is plenty of evidence for its usefulness under certain circumstances. For example, there is a well-established relationship between IQ and working memory (Mackintosh, 2013) and it is still a significant predictor of academic success (Snyderman and Rothman, 1993). And yet, perhaps we would expect this. As neuroscientist Steven Rose, writing in the TES, notes: "IQ scores do correlate reasonably well with school performance, but this is what they were designed to do.". In addition, Rose argues that although a child's performance at school is in part related to his or her IQ, it is also related to "other important factors such as motivation and self-confidence" as well as perception and memory, which are measures beyond intelligence, even.

There are critics of the IQ concept, although there is much misunderstanding of what it tries to do. Nicholas Mackintosh of The Psychometrics Centre at the University of Cambridge suggests that IQs strongest critics may well take a dim view of intelligence testing because the notion that "there might be inherited differences between people that have a substantial impact on their life chances" is highly controversial. Indeed, the idea "[t]hat a two-hour pencil-and-paper exam purports to tell us something about our *inherent* worth is onerous to most of us" (Mark Snyderman and Stanley Rothman, 1990. p75).

But if we can make some criticisms that demand a search for an alternative view of intelligence for educators, let us say that:

1) IQ offers no formative utility to teachers or to learners themselves. To improve IQ score, one can only really practise IQ tests, which serves little purpose in the real world.

2) Neither does IQ capture all aspects of human intelligence. Although psychometricians would disagree with much concerning the idea of 'multiple intelligences', claims Mackintosh, Howard Gardner's idea helps educators to move beyond the favouring of a narrow range of cognitive abilities, and to give parity of esteem to the non-academic and practical. In general, educationalists are sceptical of the utility of intelligence tests, arguing that IQ measures ignore creativity, and artistic and emotional intelligence (Steven Rose, 2014).

3) More significant than either argument is this one from Sternberg: that

> "the preoccupation with [intelligence] testing has been based on certain assumptions, at least one of which is in serious error. This assumption is that intelligence is, for the most part, a fixed and immutable characteristic of the individual". (p38).

He argues that a preoccupation with testing for intelligence is both unnecessary: why test something that is constantly changing; and neglectful: with the accompanying assumption that intelligence is fixed, the question of how intelligence can be trained for is overlooked.

If 'being smart' is less about measurable ability and more about what David Perkins and colleagues refer to as 'intelligence in the wild' then, "to define intelligence as a matter of ability without honouring the other elements that enliven it is to fail to capture its human spark" (p272).

Indeed, in real life IQ becomes a relatively poor predictor of 'being smart'. David Perkins suggests that while in laboratory and testing situations, it might be appropriate that an "abilities-centric view of intellectual performance should prevail…the challenges of exercising one's intelligence 'in the wild' are strikingly different from those in such tame laboratory and testing situations" (p270). Day-to-day life presents us with ill-defined, vague, and oftentimes hidden, opportunities to engage with problems and decisions in a thoughtful way.

Perkins notes that the growing body of literature representing this need for thinking in the real world is bracketed under the shorthand of 'thinking dispositions'. And it is these dispositions that those committed to the idea of expandable intelligence believe are the key to stretching individuals' capabilities.

Beth Visser, Michael Ashton and Philip Vernon (2006) Beyond g: Putting multiple intelligences theory to the test. *Intelligence*. 34: 487-502 http://www.sciencedirect.com/science/article/pii/S0160289606000201

Bill Lucas (2007) New Kinds of Smart: Emerging thinking about what it is to be intelligent today. Winchester: The Talent Foundation

David Perkins (1995) Outsmarting IQ: The emerging science of learnable intelligence New York: The Free Press

David Perkins, Shari Tishman, Ron Ritchhart, Kiki Donis and Al Andrade (2000) Intelligence in the Wild: A dispositional view of intellectual traits. *Educational Psychology Review.* 12(3): 269-293

Howard Gardner (1993) *Frames of Mind: The Theory of Multiple Intelligences*. London: Fontana Press

Mark Snyderman and Stanley Rothman (1990) *The IQ Controversy: The media and public policy.* New Jersey: Transaction Publishers

Nicholas Mackintosh (2014) Why Teach Intelligence? *Intelligence.* 42: 166-170 http://dx.doi.org/10.1016/j.intell.2013.08.001

Robert Sternberg (1984) How Can We Teach Intelligence? *Educational Leadership.* 42(1): 38-48

Steven Rose (2014) Is Genius In The Genes? *Times Educational Supplement.* Friday 24 January, No.5079

Learnable intelligence: an emerging science

So intelligence is (largely) learnable. But does this apply all the time?

One objection to the idea of learnable intelligence comes from teachers noticing how some children soak up learning like sponges while others "just don't get it". While some are open to correction and learn from mistakes, others seem to repeat theirs time and again. Teachers might argue that success can't just be about effort, because plenty of children seem to try hard and fail. In response to the question of whether all children are created equal, Carol Dweck (p62) says (perhaps surprisingly):

> "No, some children are different… [some] seem to be born with heightened abilities and obsessive interests, and… through relentless pursuit of these interests, become amazingly accomplished".

BUT, she argues, while most people believe that this 'gift' is the ability itself, "what feeds [ability] is that constant, endless curiosity and challenge seeking". Perhaps the gift is actually the highly developed habits of mind that allow excellence to develop.

On the whole, 'expandable' approaches to intelligence do not presume that 'all are created equal' with respect to their cognitive equipment. Neither do they rule out the existence of child prodigies. Indeed, recent research has apparently demonstrated that the skills of child prodigies are "highly dependent on a few features of their cognitive profiles..." (Joanne Ruthsatz and colleagues, 2013). They do, however, recognise that a significant portion of intelligence is learnable (Heidi Goodrich Andrade and David Perkins, 2007). Human intelligence "is not simply a matter of gray matter but also a matter of what is put in it and how it is used" (p67). The authors propose that educators work with the parts they can exert influence over because research on learnable intelligence allows the making of two bold claims:

1) That students can be taught to behave more intelligently
2) That teaching for intelligence can lead to improvements in academic achievement.

Happily for teachers, Andrade and Perkins suggest that teaching for intelligence, and covering material required by the curriculum need not be conflicting endeavours.

A central aspect of learnable intelligence for Andrade and Perkins is the idea of metacognition and the related notion of self-assessment – or self-awareness, and its revision of drafts, and seeking of appropriate help.

They propose that intelligence can be taught by reorganising thinking (p74). Whichever method or brand of intelligence training is used, five CORE (COgnitive REorganisation) categories provide a means for schools to appraise the approach to ensure it caters for each area and that none are neglected:

- Strategies: step-by-step procedures that guide thinking about a problem
- Metacognition: monitoring and directing your own thinking
- Dispositions: develop tendencies to think in certain ways (flexibly, rigorously)
- Distributed cognition: interaction with devices, resources, other people
- Transfer: carrying knowledge and understanding across contexts

In terms of the impacts of practices related to learnable intelligence upon achievement, these are (statistically) significant. For example, John Hattie's (p297 Appendix B) meta-analysis of over 800 achievement studies yielded the following effect sizes (and anything greater than 0.4 is significant):

- Meta-cognitive strategies 0.69
- Self-verbalization/self-questioning 0.64
- Concentration/persistence/engagement 0.48

Heidi Goodrich Andrade and David Perkins (2007) Learnable Intelligence and Intelligent Learning in Robert Sternberg and Wendy Williams (Eds) (2007) Intelligence, Instruction, and Assessment: Theory into practice. Lawrence Erlbaum Associates: London
http://books.google.co.uk/books?hl=en&lr=&id=MzYXNO1v6eYC&oi=fnd&pg=PA67&dq=learnable+intelligence&ots=iQkJrNiZiw&sig=V1JrlTmzl2CfrZaSJIvytFWSTYo#v=onepage&q=learnable%20intelligence&f=false

Joanne Ruthsatz, Kyle Ruthsatz, Kimberly Ruthsatz Stephens (2013) Putting Practice Into Perspective: Child prodigies as evidence of innate talent. *Intelligence* Online September 2013

John Hattie (2009) *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement*. Oxon: Routledge

The importance of mindset

Not only is intelligence expandable, whether or not you agree with this notion actually affects the way you live your life and the approach you take to learning. Stanford Professor Carol Dweck describes two types of mindset and their impacts:

> Believing that your qualities are carved in stone – the fixed mindset – creates an urgency to prove yourself over and over. If you have only a certain amount of intelligence, a certain personality, a certain moral character – well, then you'd better prove that you have a healthy dose of them. It simply wouldn't do to look or feel deficient in these most basic characteristics.
>
> There's another mindset in which these traits are not simply a hand you're dealt and have to live with, always trying to convince yourself and others that you have a royal flush when you're secretly worried it's a pair of tens. In this mindset, the hand you're dealt is just the starting point for development. This growth mindset is based on the belief that your basic qualities are things you can cultivate through your efforts. Although people may differ in every which way – in their initial talents and aptitudes, interest, or temperaments – everyone can change and grow through application and experience.

The effects of mindset are significant and its implications are profound for educational practitioners. In schools, the kinds of language that we use, the way we explain ideas about intelligence to learners, the expectations we have for each of them, and even the way we praise children – for effort or intelligence – should be considered very carefully in light of this.

Dweck and her team looked at students in the US leaving elementary education. The work, and the environment in which students had to perform, toughened significantly. The grades of students with fixed mindsets started to plummet and declined over the following two years. The converse was true for those with a growth mindset. These students 'mobilized their resources for learning'.

While this does not mean that every child can become a prodigy, it does mean that – given the right mindset and the right input from teachers – children are capable of much more than we might think. Dweck cites examples of teachers – themselves displaying a belief in the growth mindset – who have accomplished astounding things: for example, inner city Hispanic high school students learning college-level calculus because their teacher asked "how will they learn best?" rather than "can they learn?". And inner city public school children surpassing all expectations of progress in reading levels because their teacher treated them like geniuses.

On this matter, Philip Adey and colleagues (1997; p93) argue that:

> As long as educators see intelligence as something essentially fixed which predetermines their students' ability to process all kinds of data they would be quite right to treat it with great suspicion, as a lurking force which undermines all of their efforts. But as soon as one accepts the fact that the functioning of the general intellectual processor in the mind can be improved by education, then the construct of intelligence becomes more acceptable than in the past. It no longer has ultimate control over our students' ability to learn, and the tables are turned so that educators now have it in their power to raise their students' general cognitive ability, and to raise all of their academic performance.
>
> This is more than just a matter of losing our shackles. It should actually define the mission of education, its primary purpose. If we know that we can help our students throughout their formal schooling period continually to raise their ability to process information – any sort of information – then surely this must be what we should be striving for.

Carol Dweck (2007) Mindset The New Psychology of Success: How we can learn to fulfil our potential. New York: Ballantine Books

Case study: people's own internal theories about intelligence predict achievement

Two studies explored how children's 'implicit theories of intelligence' – that is, the belief they hold about whether intelligence is malleable or fixed – impacted upon achievement in mathematics. In the first study, a belief that intelligence is malleable actually predicted an upward trajectory in grades over the two years of 'Junior High'.

> This research confirms that adolescents who endorse more of an incremental theory of malleable intelligence also endorse stronger learning goals, hold more positive beliefs about effort, and make fewer ability-based, ''helpless'' attributions, with the result that they choose more positive, effort-based strategies in response to failure, boosting mathematics achievement over the junior high school transition.

In the second study, teachers promoted positive change in classroom motivation by teaching students to think of intelligence as malleable.

> Teaching a malleable theory of intelligence was successful in enhancing students' motivation in their mathematics class, according to teacher reports. The experimental group, in addition, showed no decline in math performance after the intervention (as opposed to the decline found for them before the intervention and the continued declining grades found for the control group).

Lisa Blackwell, Kali Trzesniewski, and Carol Dweck (2007) Implicit Theories of Intelligence Predict Achievement Across an Adolescent Transition: A longitudinal study and an intervention. *Child Development* 78(1): 246-264

Training for intelligence: signature pedagogies

The editors of *Signature Pedagogies* argue that good teachers want students to understand and practise "disciplinary ways of thinking or habits of mind". For example, English teachers need to teach students to read texts in the way a literary scholar would.

In the same book, Joel Sipress and David Voelker propose a teaching model that moves from 'coverage' (of a subject) to 'doing' the subject. Under this model, teachers create "a deliberate attempt to lay bare for students the central assumptions, forms of inquiry, and cognitive habits that transform data into knowledge for practitioners of our discipline" (p24). For example, in History, students at all levels are "presented with and asked to think creatively about the raw materials of history and of historical debate".

A central goal of teaching history, for example, becomes helping students to think like historians. For one scholar this is done by systematically introducing students to a "culture of argument", and making this explicit in the syllabus, course texts and projects. It is important that thinking like a [fill in the blank] becomes the organising principle of the course, not just a bolt-on whereby teachers make a little bit of space for students to think like a historian.

Regan Gurung, Nancy Chick and Aeron Haynie (Eds.) (2009) *Exploring Signature Pedagogies: Approaches to teaching disciplinary habits of mind*. Virginia: Stylus Publishing LLC

Training for intelligence: thinking skills

Back in 1984 Robert Sternberg proposed that there were three programmes in the US for teaching thinking and that these were necessary because there had been an "unprecedented decline in the intellectual skills of our school children" (p47).

1. Reuven Feuerstein's *Instrumental Enrichment*. Feuerstein took the view that intelligence is not a fixed entity, rather it is a function of individuals' experiences and the impacts of significant others upon those experiences (Art Costa and Bena Kallick, 2008);
2. Matthew Lipman's *Philosophy for Children*; both of which emphasis thinking skills; and
3. Beau Fly Jones's *Chicago Mastery Learning Reading Program* which emphasises learning strategies and study skills.

Edward de Bono, creator of the Six Thinking Hats tool, adds:

4. The *Cognitive Research Trust* program.

While the UK has seen the arrival and departure of thinking skills within the curriculum (for example, the Personal Learning and Thinking Skills framework introduced at Key Stages 3 and 4, which earmarked room within the school day for development of six groups of skills), many schools implement similar programmes.

The key to their success is to ensure thinking skills are 'infused' across the curriculum rather than being taught as stand-alone lessons (Barry Beyer, 2008 provides a review of the literature about this). This being said, Beyer cites evidence that where thinking skills are taught in one context learners do benefit from instruction in how to transfer thinking skills across contexts. *Expansive Education: Teaching learners for the real world* provides examples of how successful schools have implemented thinking programmes.

As a teacher, how can you bring ideas of mindset (not just effort and attainment) into class? *New Kinds of Smart* provides some ideas:

- Should I rethink my use of praise and what it means to achieve?
- Do I subscribe to the fixed view or the growth view of intelligence?
- How can I communicate the idea of growth mindset to my classes?
- How can I help young people develop growth mindsets in and out of school?

- Could I use ideas of 'learning dispositions' rather than 'abilities' when talking about learning?
- Which learning dispositions might I value the most and how might I promote them in class and in school?
- How can I help parents to cultivate growth mindsets in their children?
- Could I help learners to track development of their mental growth?

Art Costa and Bena Kallick (Eds.) (2008) *Leading and Learning with Habits of Mind: 16 essential characteristics for success.* Alexandria VA: Association for Supervision and Curriculum Development

Barry K. Beyer (2008) What Research Tells Us about Teaching Thinking Skills, The Social Studies, 99:5, 223-232, http://www.tandfonline.com/doi/abs/10.3200/TSSS.99.5.223-232#.Ut5Hl9JFDsM

Bill Lucas, Guy Claxton, and Ellen Spencer (2013) *Expansive Education: Teaching learners for the real world.* Berkshire: Open University Press

Brett Jones, Lee Rakes, and Krista Landon (2013) Malawian Secondary Students' Beliefs About Intelligence. *International Journal of Psychology.* 48(5): 785-796 http://dx.doi.org/10.1080/00207594.2012.716906

Edward de Bono (1983) The Direct Teaching of Thinking as a Skill. *Phi Delta Kappan.* 64: 703-708 http://webarchive.nationalarchives.gov.uk/20110223175304/http:/curriculum.qcda.gov.uk/key-stages-3-and-4/skills/personal-learning-and-thinking-skills/index.aspx The six groups of skills were: independent enquirers, creative thinkers, reflective learners, team workers, self-managers, and effective participants.

Training for intelligence: optimism

Related to the growth mindset idea is the area of positive psychology. An 'optimistic' person is not someone who hopes for the best, but someone who believes they have a significant internal locus of control, i.e. that much of what happens to them is in their own power. When things go wrong, the optimistic person sees them for what they are: one-off setbacks that could happen to anyone, but won't necessarily happen again, and certainly don't form a pattern for all their experiences. While it is possible to be blindly optimistic – and this can indicate a lack of introspective reflection or even of ownership – the person who sees himself as a victim of his environment is similarly unwilling to take responsibility, and yet simultaneously does not enjoy the benefits a little effort, practice and risk could bring.

Teachers can train for optimism by bringing the idea into lessons overtly. For example, by first explaining the concept. Or by setting children a reflection and discussion task around the question: "how do I react when things go wrong in lessons?". In English, for example, teachers might foreground optimism in discussing key events in a book character's life.

Alternatively, optimism might be woven through a lesson more subtly: from initial lesson set-up and reward and incentive planning that incorporate optimistic behaviour, to teacher modeling of feedback and *Assessment for Learning* strategies that value optimism.

Training for intelligence: grouping by ability

Should children be grouped by ability? In *New Kinds of Smart*, Bill and Guy argue that there is no scientific justification for categorizing children according to their 'ability', 'intelligence', or 'potential'. While any snapshot of a classroom will show differing levels of achievement and performance, organization of children according to these current levels is really just "a pragmatic question of how best to help them all improve". By labelling according to ability, children's current performance levels become 'fatalistic predictions about what can be expected of them'. John Hattie (2009) suggests that quality of teaching and the nature of the student interactions are of more importance than the compositional structure of the class. Given the forthcoming loss of National Curriculum levels, teachers need to pose the question: how can I talk about each student's progress without using words like 'levels' or 'ability'?

Putting ideas into practice: some principles

As a teacher, how can you go about trying to raise general cognitive ability? Adey and colleagues suggest a number of principles:

1. Learning activities must have the potential to create challenge just at the edge of the learner's current processing ability;
2. Learners should have the opportunity to listen to one another, argue, justify, and become accustomed to changing their positions;
3. Students should he made aware of general learning that can be abstracted from domain-specific learning about a concept. For example: what was it about the concept (perhaps the way it was organised or the quantity of information) that made it difficult to process it? How can the concept be connected to others they already understand (and how can it be differentiated or old ideas abandoned if necessary)? How can students become more self-reliant and self-regulating?

Putting ideas into practice: expansive talking

The way teachers communicate is of great significance: by praising children as though their ability to think, learn, and perform can be strengthened children are more likely to demonstrate positive learning dispositions. And, significantly, to achieve greater success in school and out.

Teachers wishing to help learners to focus on the degree to which they can grow might ask learners some searching questions:

- What's going well?
- Which part did you find hardest?
- How did you deal with that?
- How else could you have approached the problem?
- What could you do when you get stuck on a problem like this?
- What might have made this easier for you?
- What mistakes did you make as you tried to figure it out?
- What could you learn from your mistakes?
- How could you help someone else to do that?
- What could I have done to teach that better?
- Where else could you use that solution?
- How could you make that more challenging for yourself?
- How did you feel when you had finished?

New Kinds of Smart (p48).

Putting ideas into practice: normalizing confusion

Learning becomes more powerful the longer students are able to wrestle with doubt and tolerate a state of uncertainty. Donna Miller (2013) Cites Sheridan Blau, who advocates for a curriculum design that fosters confusion:

> In a classroom where intellectual problems and confusion are honoured as rich occasions for learning, students and teachers will be more inclined to confront and even seek rather than avoid the textual and conceptual problems that offer the richest opportunities for learning.

To foster such an environment, teachers need to normalise the idea that students don't know everything, but can find out. The opposite approach: where doing badly is less of a risk than admitting inadequacy out of fear of embarrassment, is all too common in schools. Sometimes normalising this idea means that teachers themselves should not over-prepare, and that "preparation may be a mask hiding the very process we want students to master". Miller suggests that educators might try:

- modelling the initial false starts that come with learning
- asking questions like: "where did you struggle?" and "how are you working to solve those problems?"

Donna Miller (2013) Got It Wrong? Think again. And again. *Phi Delta Kappan* 94(5):50-52

Putting ideas into practice: dispositional thinking

Art Costa and Bena Kallick's *Habits of Mind* is a well cited and well used approach to developing the dispositions learners need for success in the real world. Costa and Kallick (2008) argue that:

> "[w]e must help students think powerfully about ideas, learn to critique as well as support others' thinking, and become thoughtful problems solvers and decision makers".

Adopting an approach such as *Habits of Mind* or *Building Learning Power* (Guy Claxton's UK equivalent developed simultaneously) involves creating and fostering a particular climate within the classroom and throughout the school. Key to these approaches is the teachers developing ability to think in two dimensions at once: the *content* dimension, and the *learning power* (or *habits of mind / dispositions)* dimension. It involves asking questions like:

- How am I going to get this concept across?; as well as:
- What learning dispositions am I going to focus on developing?

Building Learning Power gives some examples (2002, p103)

> How could I commentate in a way that would help develop resourcefulness / imagination with my year 11 French group? Maybe I could make an effort to use more 'could be' language when we're discussing this French translation, or exploring the pros and cons of strictly literal versus more poetic interpretations.

> How could I model reflectiveness / planning in the context of this unit on simultaneous equations? Maybe I could set up a difficult problem on the board and talk aloud about how I think I could try to tackle it, how long I reckon it might take me, or what resources I suspect I might need. Then maybe I could give them a different problem and orchestrate a similar kind of discussion in pairs.

Guy Claxton (2002) *Building Learning Power*. Bristol: TLO

Putting ideas into practice: assessing intelligence

Instead of trying to assign a number, or level, on individuals' intelligence, teachers might more usefully describe individuals' strengths, gifts, and needs, by questioning, observing, and reflecting together.

Instead of comparing children with their peers, look at what they know and can do in relation to what they have been taught.

Instead of pencil-and-paper testing, use authentic forms of assessment in which pupils perform real-world tasks and demonstrate that they have applied knowledge and skills in a meaningful way.

Look at the full range of areas in which the child can demonstrate intelligence. Do not use 'numeracy' as your only indicator of thinking power.

Instead of snapshot testing at the end of units of work, try thinking of progress in terms of a portfolio of each child's progress against development goals. Invite learners to contribute their own pieces of 'evidence', based on learning objectives they are familiar with. Hold conversations about the strength of each piece of evidence, and what it shows. Make exemplars visible.

Colin Newton (2009) *Problems with IQ and Psychometric Assessment* Inclusive Solutions Available: http://www.inclusive-solutions.com/word/IQ_Problems_Jan.doc

Research summary compiled by Ellen Spencer at the Centre for Real-World Learning