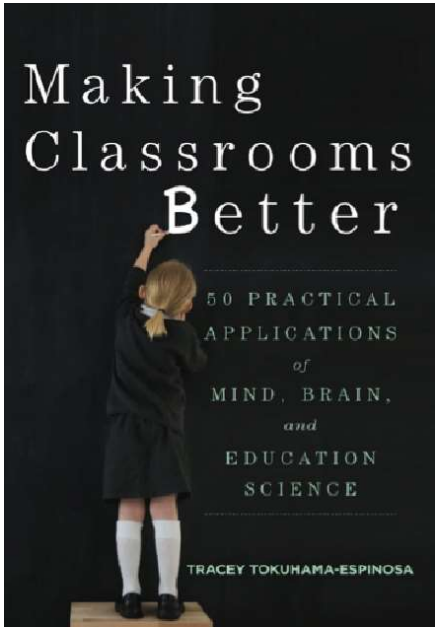
Making Classrooms Better:



Practical applications of Mind, Brain, and Education science

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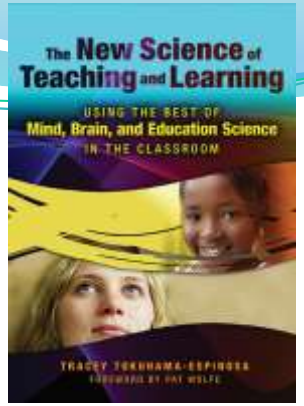
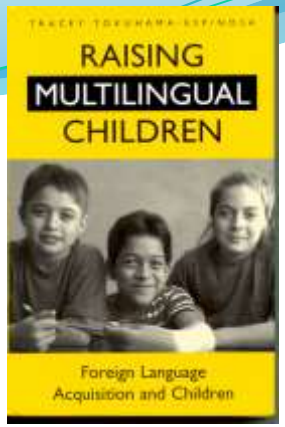
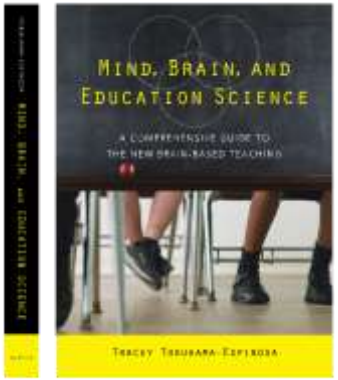
traceytokuhamaespinosa@gmail.com

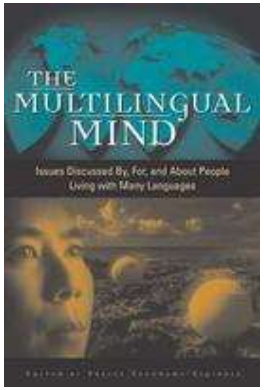
Background

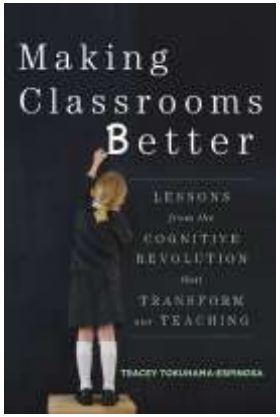
- Professor of “Learning Sciences” course, Harvard University.
- Member of the OECD exert panel to redefine Teachers New Pedagogical Knowledge.
- BA and BS from Boston University in International Relations and Mass Communication (*magna cum laude*). Master’s from Harvard University in International Education and Development and doctorate (Ph.D.) from Capella University (cross-disciplinary approach comparing findings in neuroscience, psychology, pedagogy, cultural anthropology and linguistics).
- Author, Researcher, Teacher (pre-kindergarten through university) with 25 years of comparative research and work in 25 different countries.
- Three children (raised in English, Spanish, German and French).

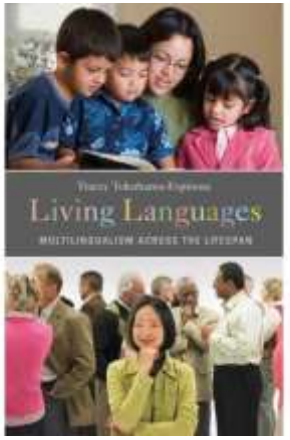






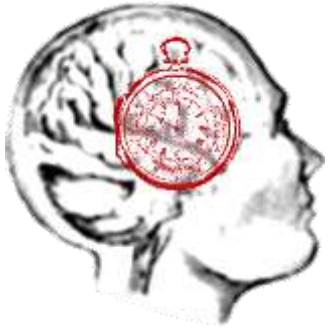






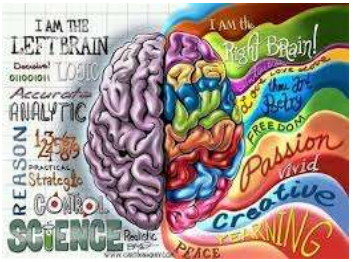
Today's focus

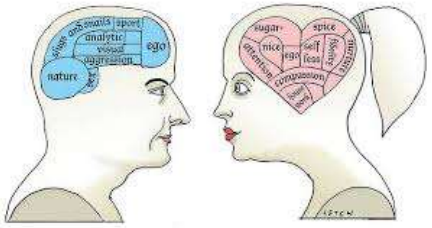
1. How and Why Teaching and Learning Have Changed Due to New Discoveries About the Brain (thanks to Technology) and Refined Educational Research
2. From "Education" to "Learning Sciences"
3. New Model of Teaching: "Visible Learning" + Mind, Brain, and Education Science
4. How Does This Change Our Practice?
   - Best Classroom Practices

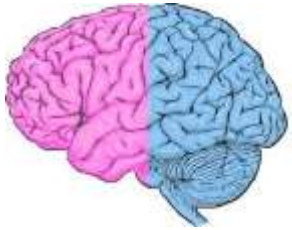


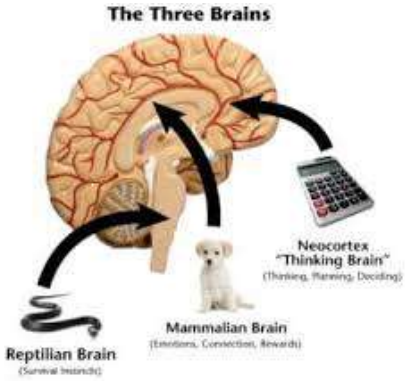
Better knowledge about the brain and learning

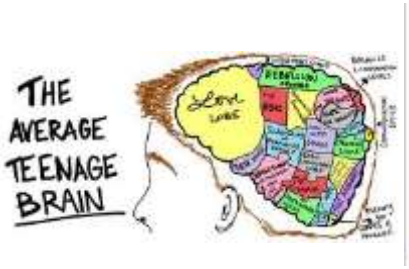
- Improvements in technology since The Decade of the Brain (1990s) have yielded greater insights about health brain functioning. Early models promoted neuromyths.

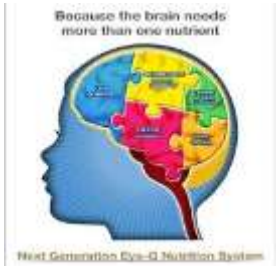


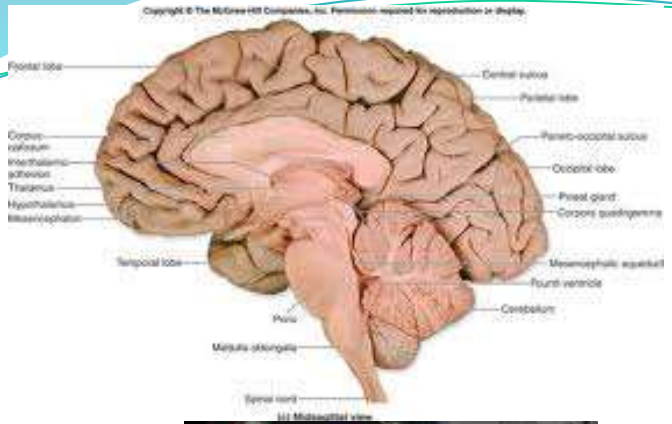


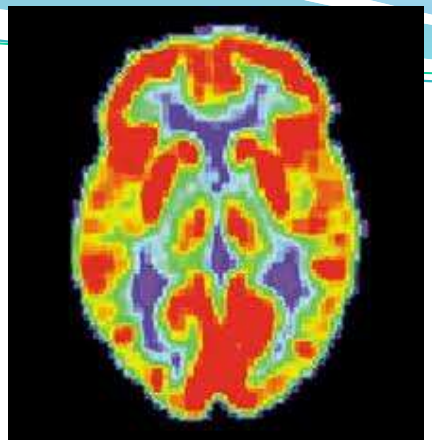


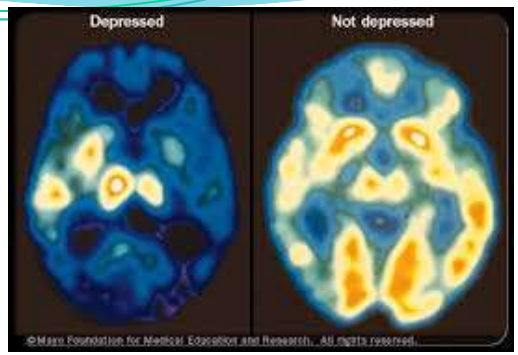


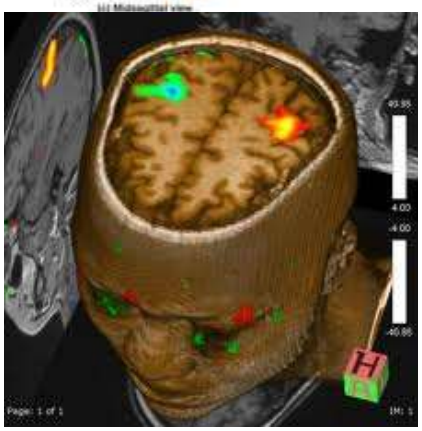


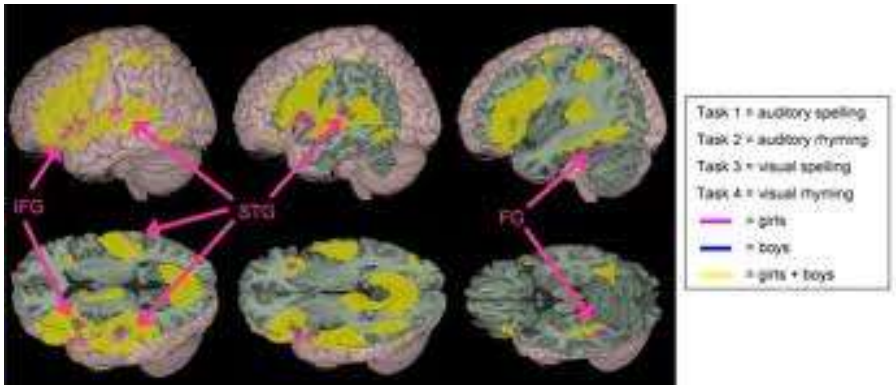


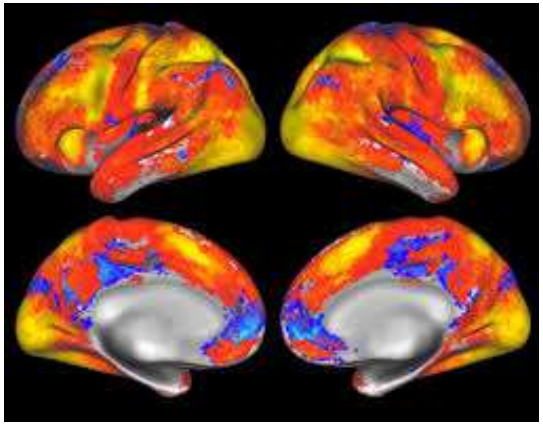

Frontal lobe
Central sulcus
Parietal lobe
Parieto-occipital sulcus
Occipital lobe
Pineal gland
Corpora quadrigemina
Temporal lobe
Fourth ventricle
Cerebellum
Pons
Medulla oblongata
Spinal cord

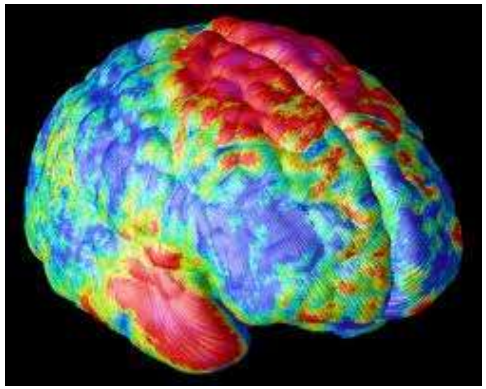


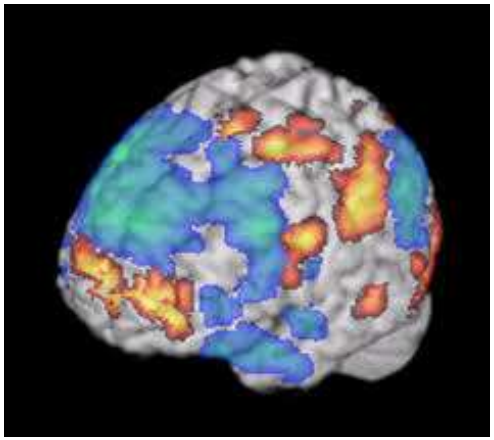

Depressed
Not depressed



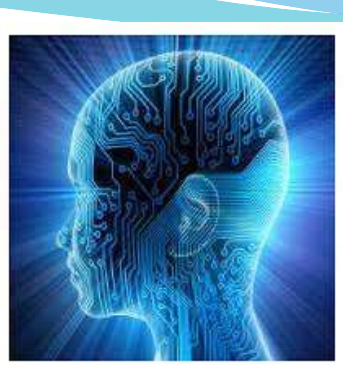

IFG
STG
FG
Task 1 = auditory spelling
Task 2 = auditory rhyming
Task 3 = visual spelling
Task 4 = visual rhyming
= girls
= boys
= girls + boys



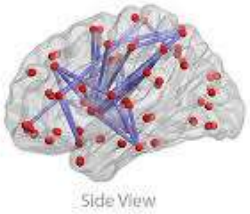


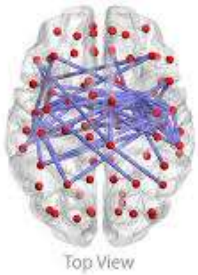


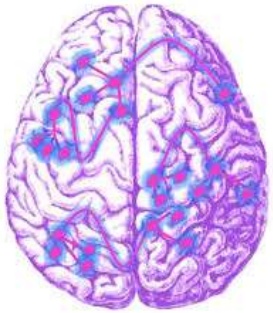
Refined technology (healthy subjects)



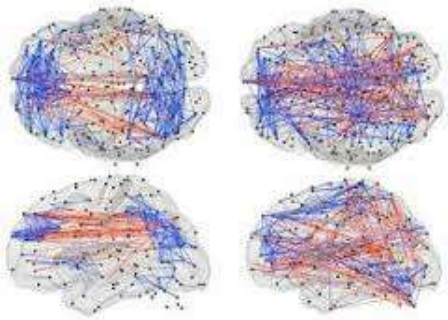
Replicas of connections

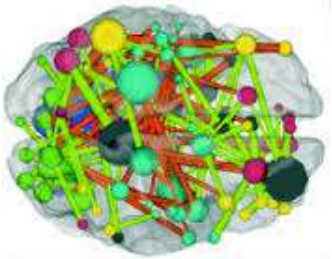


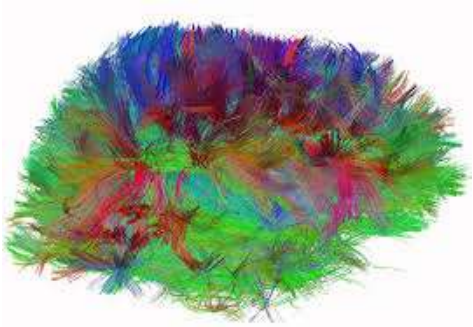


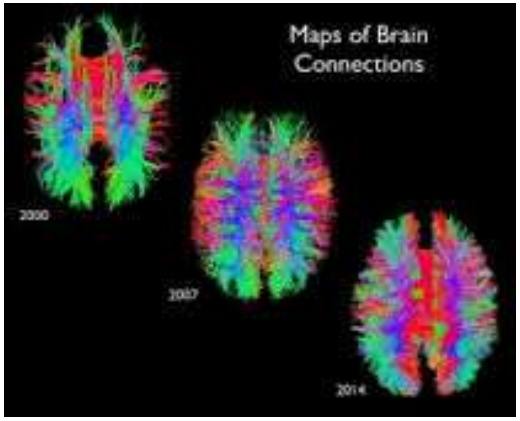


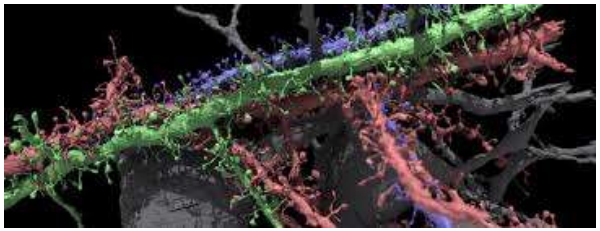
Simple models











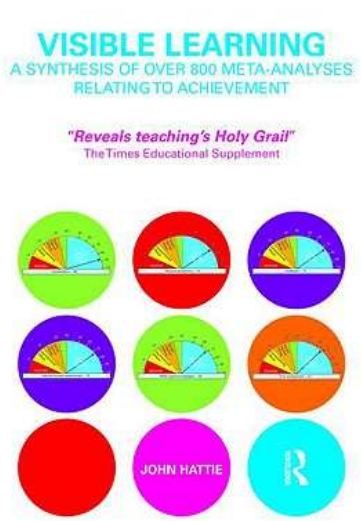
Actual computer enhanced connections

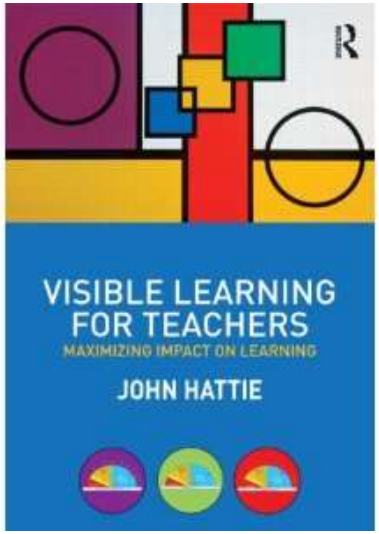
Better knowledge about what really influences teaching and learning outcomes

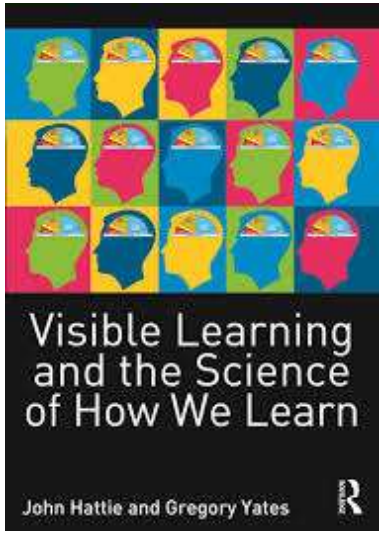
- Longitudinal studies (age comparative)
- International comparative studies (independent of cultural context=what is true for “all”)
- Methodologically comparative scale

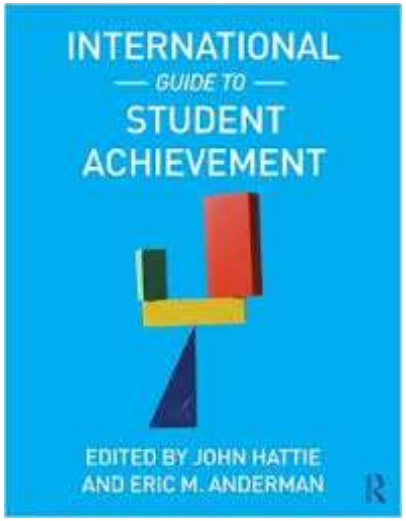
John Hattie (2009; 2012; 2013; 2014)

Starting point: High quality educational research





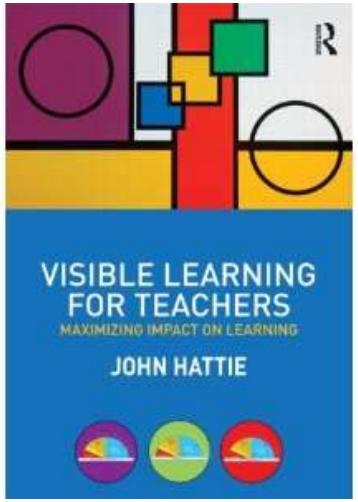




900 meta analyses; 50,000 studies; 2.4 million students

Hattie (2012)

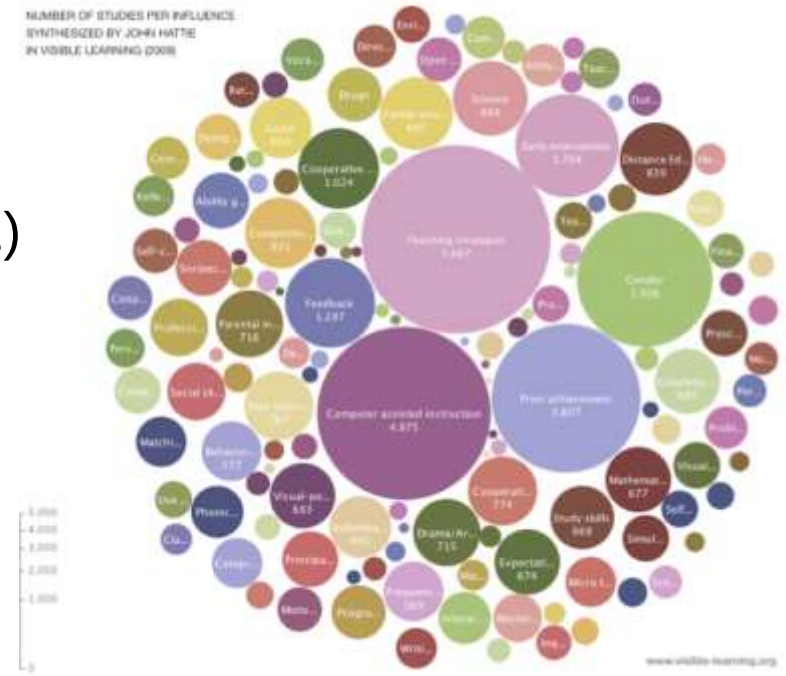
- There are 150 influences on student learning outcomes that have been well documented, including low birth weight, summer vacations, television, teaching interventions, home life…
- Teachers can impact 47 of these.



Hattie's 10 areas of influence

(as categorized in Tokuhama-Espinosa, 2014 with Hattie's permission)

1. Student self-efficacy (n=2)
2. Reinforcement learning (n=4)
3. Knowing students (n=7)
4. Teacher as seen by students (n=2)
5. Thinking about thinking (n=6)
6. Teacher self-improvement (n=2)
7. Clear objectives (n=4)
8. Group learning (n=7)
9. Managing (n=4)
10. Activities (n=9)

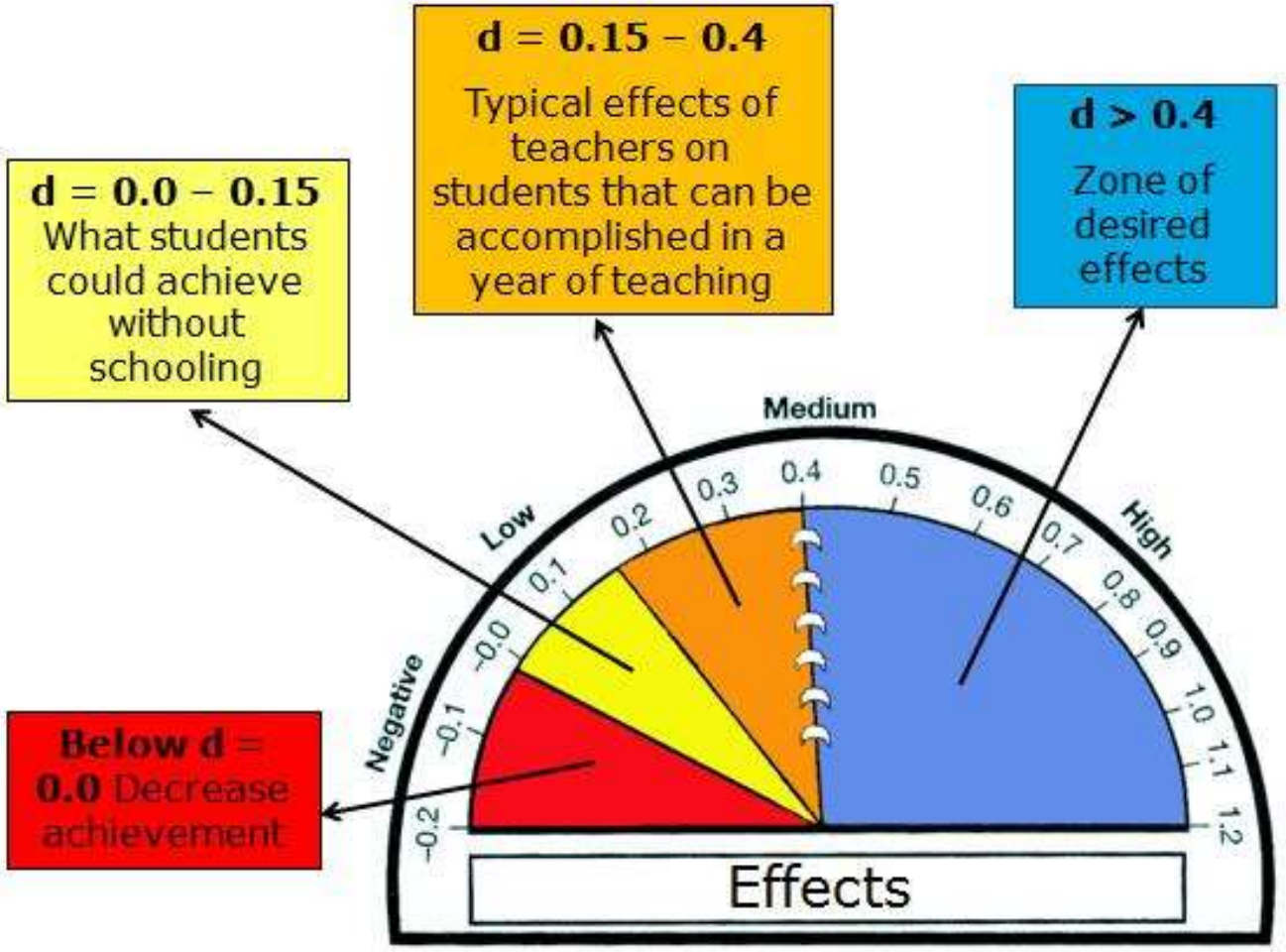


	Ranking (based on effect size)	Domain	Effect size	Measure (intervention, methodology, condition, activity)	Category
1	1	Student	1.44	Self-reported grades/Student self-expectations/Self-efficacy	Student self-efficacy
2	2	Student	1.28	Piagetian (constructivist) programs	Reinforcement learning
3	3	Student	1.07	Response to intervention (attitude)	Knowing students
4	4	Teacher	0.90	Teacher credibility	Teacher as seen by students
5	4	Teaching	0.90	Formative evaluation	Thinking about thinking
6	6	Teacher	0.88	Microteaching	Teacher self-improvement
7	7	Teaching	0.82	Classroom discussion	Clear objectives
8	9	Teacher	0.75	Teacher clarity	Clear objectives
9	10	Teaching	0.75	Feedback	Thinking about thinking
10	11	Teaching	0.74	Reciprocal teaching	Group learning
11	12	Teacher	0.72	Teacher-student relationships	Knowing students
12	13	Teaching	0.71	Spaced vs. mass learning	Reinforcement learning
13	14	Teaching	0.69	Metacognitive practices	Thinking about thinking
14	15	School	0.68	Acceleration	Knowing students
15	16	School	0.68	Classroom behavior	Managing
16	21	Teaching	0.64	Self-verbalization and self-questioning	Thinking about thinking
17	22	Teaching	0.63	Study skills	Thinking about thinking

18	23	Teaching	0.62	Teaching strategies (explanation, elaboration, modeling, demonstration, reminders of procedures, etc.)	Activities
19	24	Teaching	0.61	Problem-solving teaching	Thinking about thinking
20	25	Teacher	0.61	Not labeling students	Knowing students
21	27	Teaching	0.60	Concept mapping	Activities
22	28	Teaching	0.59	Cooperative vs. individualistic learning	Group learning
23	29	Teaching	0.59	Direct instruction	Activities
24	31	Teaching	0.58	Mastery learning	Reinforcement learning
25	32	Curricula	0.57	Worked examples	Activities
26	34	Teaching	0.55	Peer tutoring	Group learning
27	35	Teaching	0.54	Cooperative vs. competitive learning	Group learning
28	37	Teaching	0.54	Student-centered teaching	Activities
29	38	School	0.53	Classroom cohesion and climate	Managing
30	41	School	0.53	Peer influence	Group learning
31	42	School	0.52	Classroom management	Managing
32	47	Teacher	0.51	Professional development	Teacher self-improvement
33	48	Teaching	0.50	Goals	Clear objectives
34	50	Curricula	0.50	Second-/third-chance programs	Knowing students
35	52	School	0.49	Small-group learning	Group learning
36	53	Teaching	0.48	Questioning	Activities
37	54	Student	0.48	Concentration/persistence/engagement	Knowing students
38	56	Student	0.48	Motivation	Knowing students
39	57	Teacher	0.48	Quality of teaching as rated by students	Teacher as seen by students
40	58	Student	0.47	Early intervention	Reinforcement learning
41	59	Student	0.47	Self-concept (cognitive appraisals: descriptions of pride, worth, confidence)	Student self-efficacy
42	61	Curricula	0.44	Writing programs	Activities
43	62	Teacher	0.43	Teacher expectations	Clear objectives
44	65	Teaching	0.42	Cooperative learning	Group learning
45	66	Curricula	0.42	Exposure to reading	Activities
46	67	Teaching	0.41	Behavioral organizers/adjunct question	Activities
47	69	Student	0.40	Reducing anxiety	Managing

Source: Grouped by Author. Based on John Hattie's Visible Learning (2009; 2012).

Barometers of Influence



Example (Hattie, 2009) Actors and settings

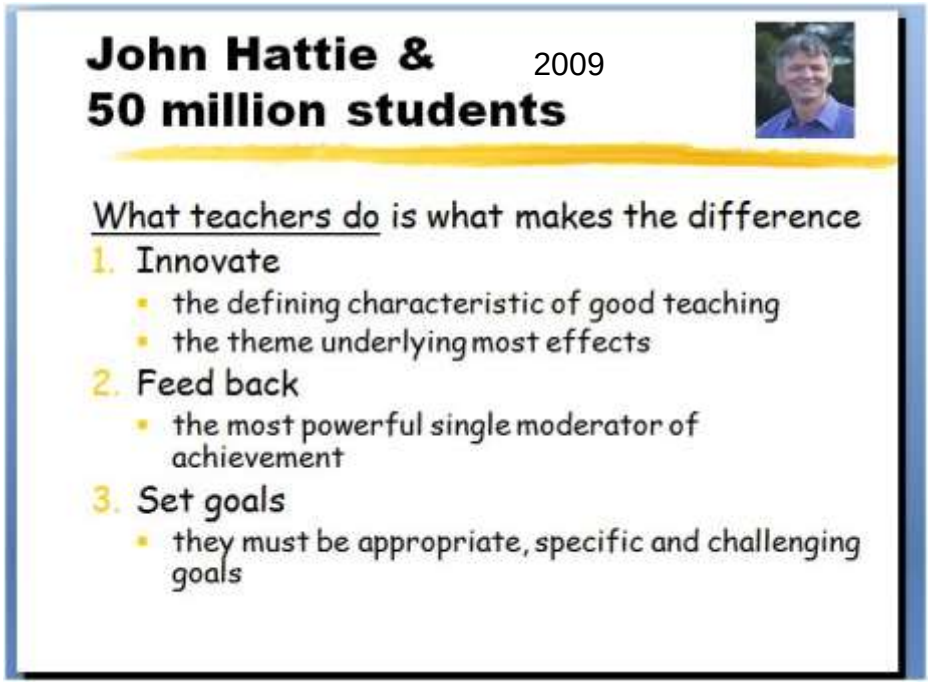
Place in rank order of influence on student learning outcomes:

- School (i.e., class and school size)
- Parents (i.e., genes versus environment)
- Home (i.e., socio-economic status)
- Teacher (as a personality)
- Student (i.e., attitude)
- Administration (i.e., leadership styles)
- Curriculum i.e., (IB versus national)
- Teaching (i.e., how information was taught; delivery)

Actors and settings

- Hattie: Rank order of influence on student outcomes

1. Student
2. Teacher
3. Teaching
4. Parents (tie)
5. Home (tie)
6. School
7. Curriculum
8. Administration



Changes in Education?

Rip van Winkle

Transportation

Banks


SAFE DEPOSIT VAULTS
AMERICAN UNION BANK
AMERICAN UNION BANK

Government


twitter
Home Profile Find People Settings Help Sign out
Question about the economy? Ask President Obama:
http://whitehouse.gov/OpenF...
about 5 hours ago from web
BarackObama
Barack Obama
© 2009 Twitter About Us Contact Blog Status Apps API Search Help Jobs Terms Privacy


YES, WE CAN TWITTER

Supermarkets

Schools….

Education has to catch up with other aspects of society! But how?

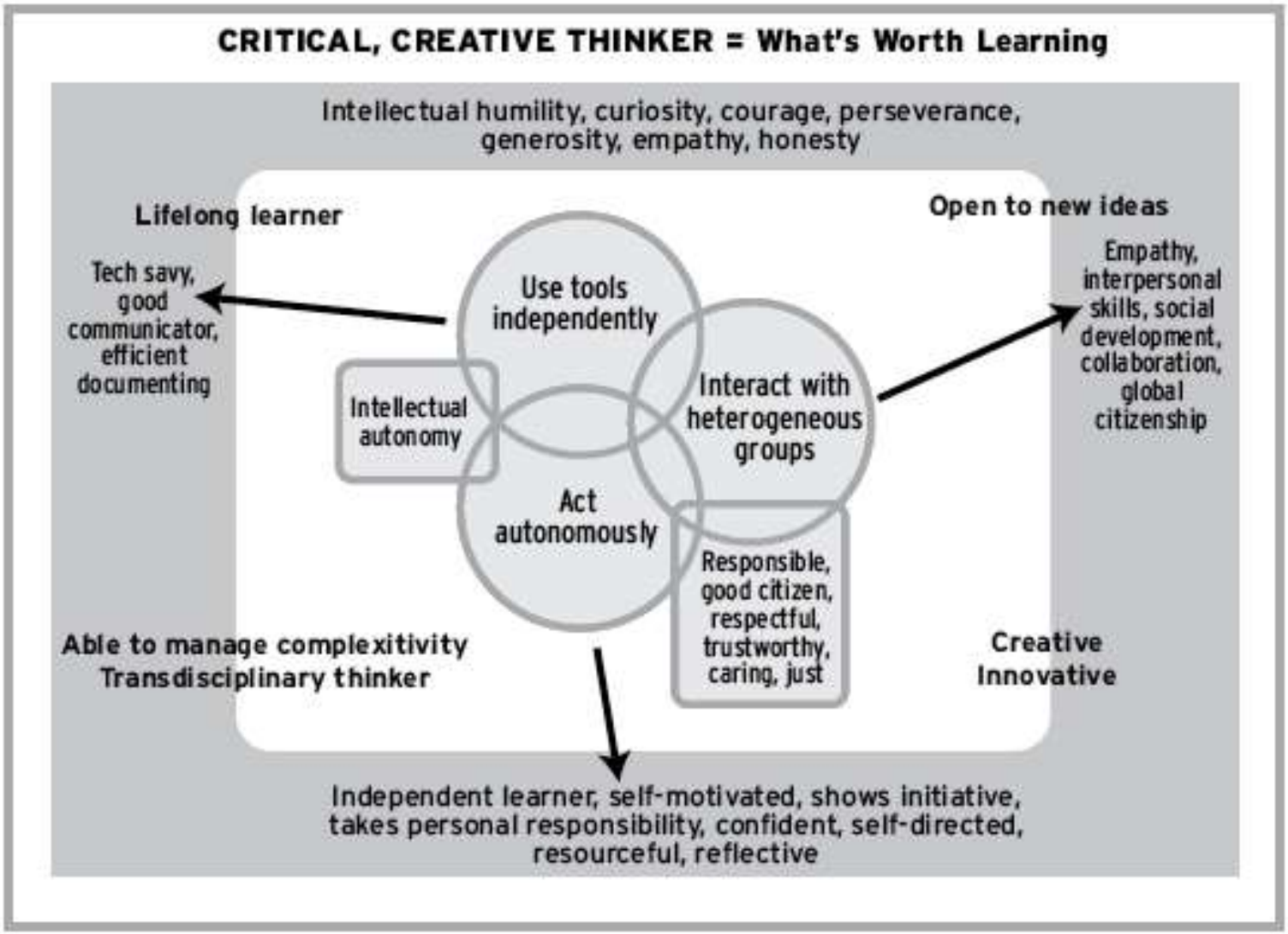
- Baby steps ➔ Bold measures

Teacher Education and 21st Century Skills http://www.youtube.com/watch?v=0eGHAuV5yLo

Changes in Educational Goals
(OECD, 2014; Tokuhama-Espinosa, 2014)

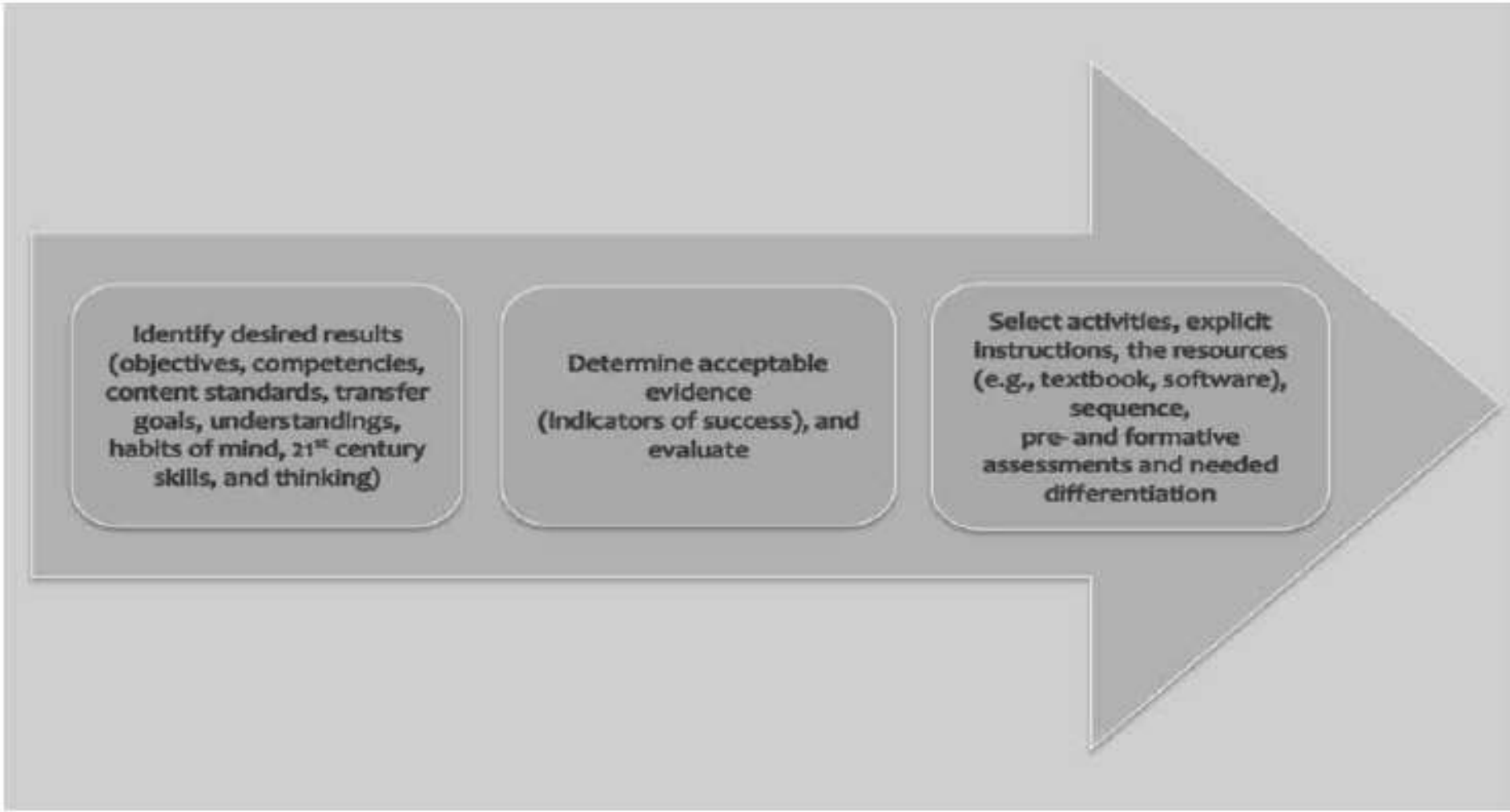
- From equal access (everyone goes to school) to equal quality.
- From teaching in silos (one subject separate from another) to transdisciplinarity.
- From “passing a class” to life-long learning.
- From traditional resources to technology integration.
- Bettering “self” to enhance collaboration, cooperation, communication, cultural awareness, building communities, and wider contextual application (bettering “the group”).

The Goals of Formal Education



Source: Author.

Backward Design Steps



Source: Adapted from Understanding by Design *(p. 9), by Grant Wiggins and Jay McTighe, Alexandria, VA: ASCD.*

Tokuhama-Espinosa, 2014, p.121

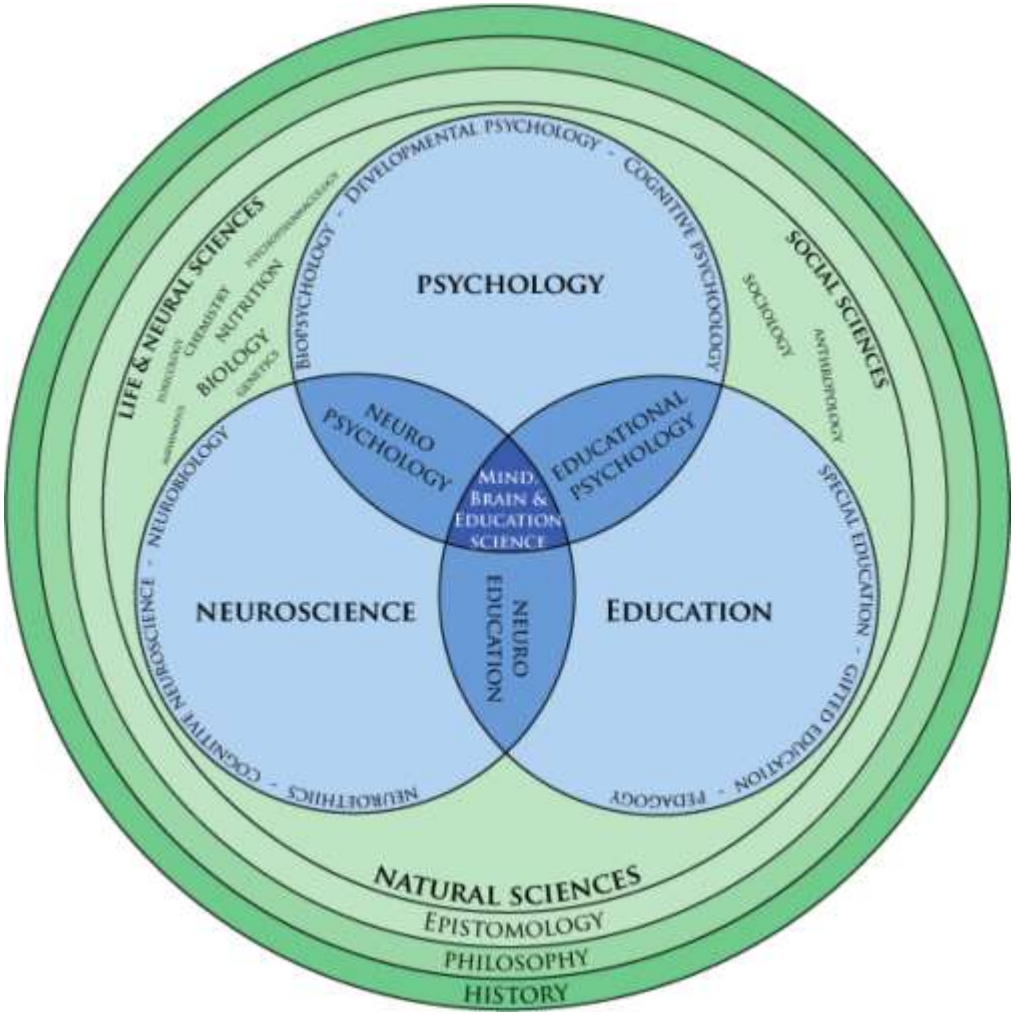
Why?

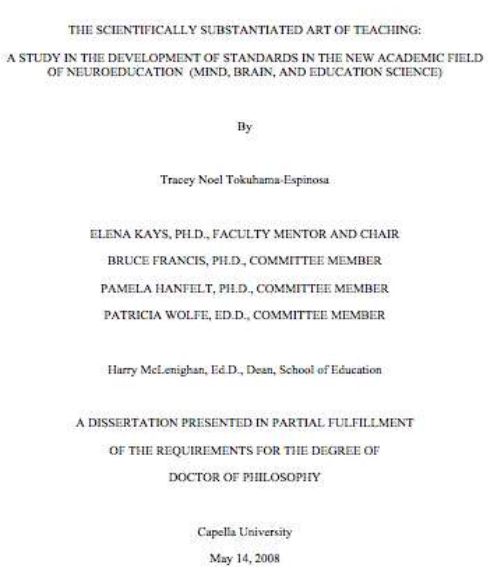
1. Small paradigm-shifts questions: Would you be willing to change certain policies in your schools or practices in your classrooms if you knew they benefited student learning?
2. NEW EVIDENCE about what influences student learning outcomes: John Hattie's *Visible Learning* + Mind, Brain, and Education science

Workshop objectives

1. Give you reason to believe that MBE science is the “new” brain-based learning.
2. Share the history of the discipline.
3. Convince (recruit? invite?) you to wear the MBE hat and embrace its shared goals of improving teaching through a better understanding of how the brain learns.
4. Distinguish “neuromyths” from “well-established” beliefs in educational practice.
5. Confirm best practice models of teaching that apply MBE standards.

From “Education” to “Learning Sciences




THE SCIENTIFICALLY SUBSTANTIATED ART OF TEACHING:

A STUDY IN THE DEVELOPMENT OF STANDARDS IN THE NEW ACADEMIC FIELD OF NEUROEDUCATION (MIND, BRAIN, AND EDUCATION SCIENCE)

By

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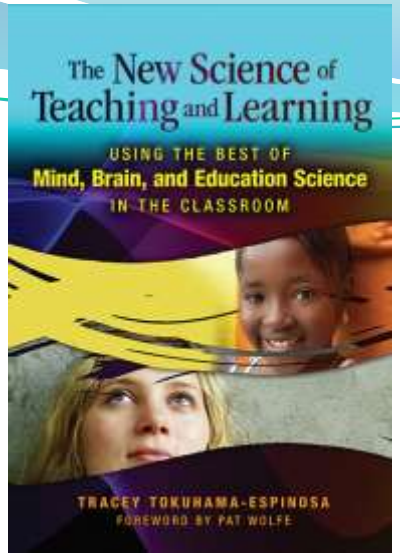
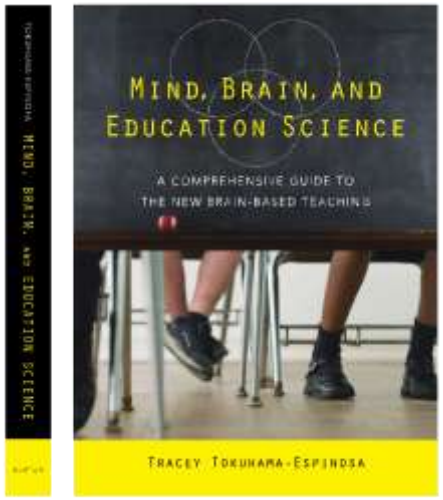
A DISSERTATION PRESENTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

Capella University
May 14, 2008

2008

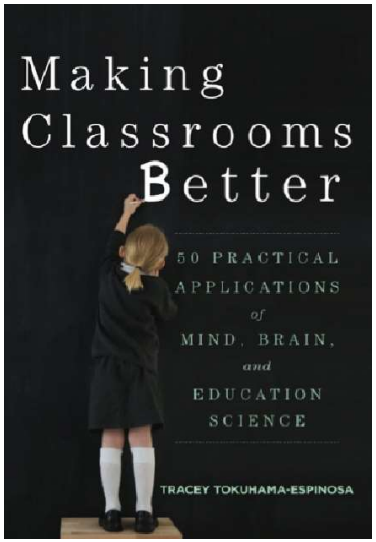


2010



2011

- "Mind, Brain, and Education (MBE) Science is the new and improved *brain-based learning*. It is the scientifically substantiated art of teaching. It is the intersection of neuroscience, education, and psychology. And it is a paradigm shift in formal education…"



2014 April

"Teachers (New) Pedagogical Knowledge"

OECD

2014 June

Tokuhama-Espinosa (2010a, p.22).

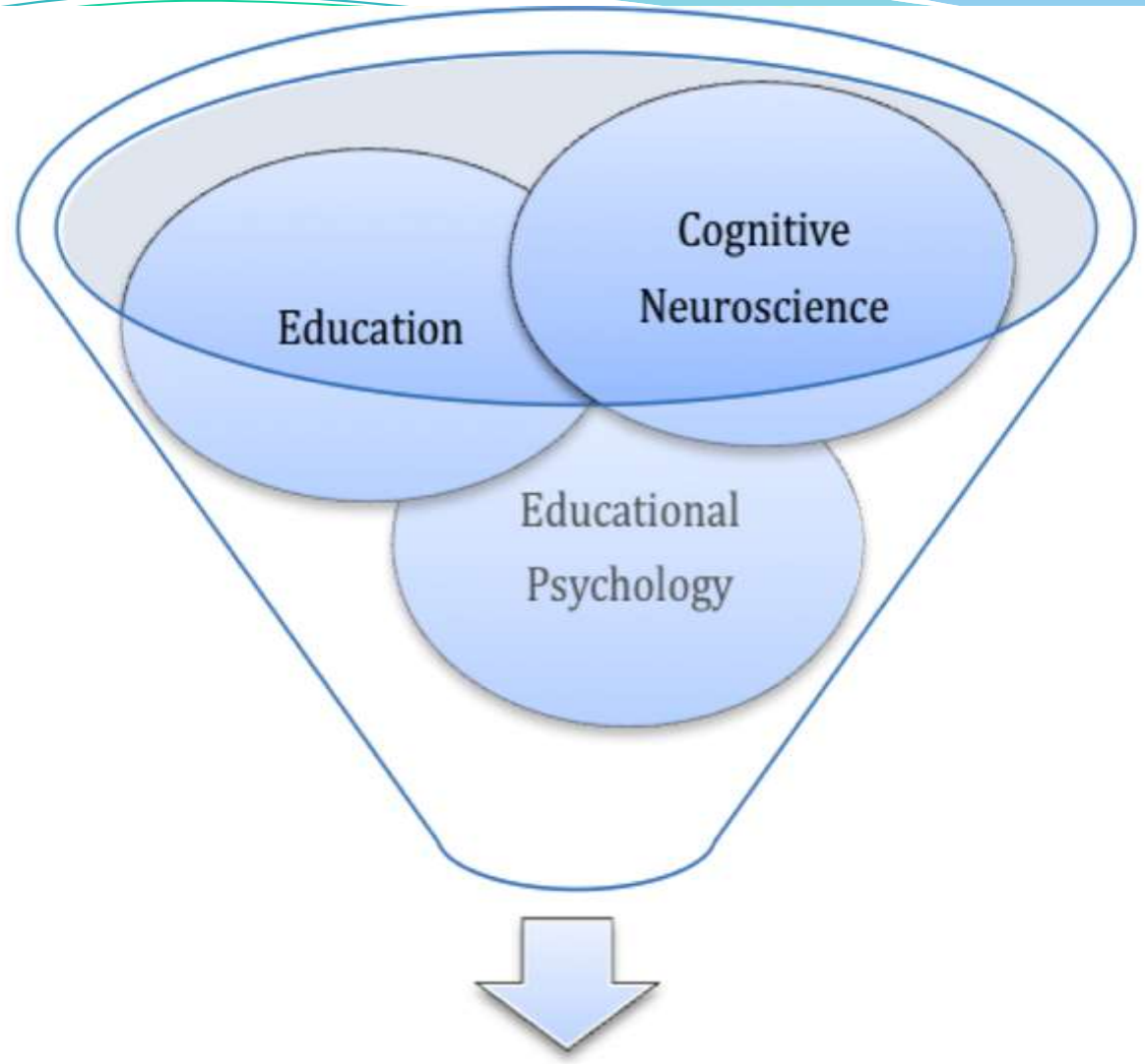
For more details on the birth of the Mind Brain, and Education field, please watch the summary video (1h48) on:
https://www.youtube.com/watch?v=-emz2QM_Qk0

- “Designing educational experiences without an understanding of the brain is like designing a glove without an understanding of the human hand.”

-Leslie Hart (1983)

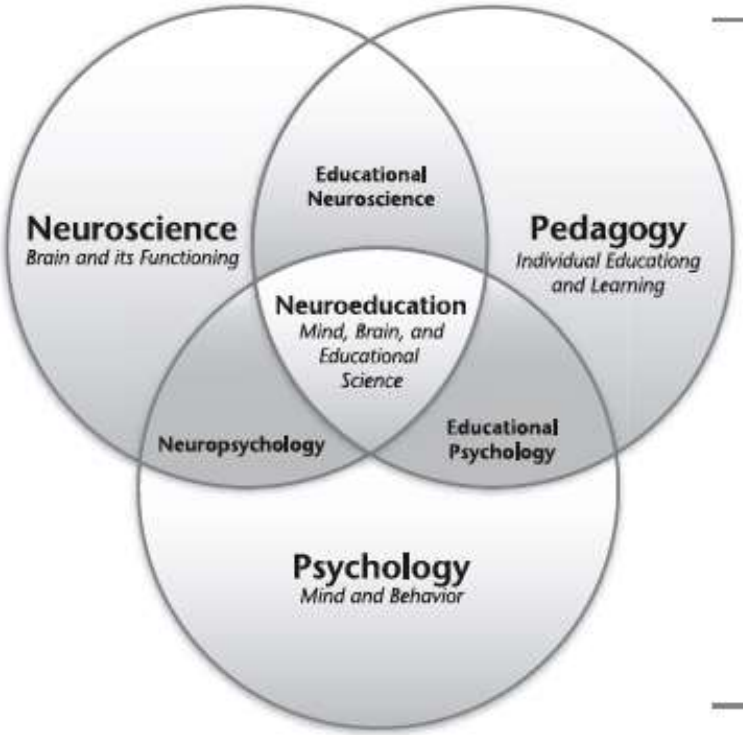
“Education is not the filling of a pail, but the lighting of a fire.”

-William Bulter Yeates (1923)



Mind, Brain, and Education Science

The Scientifically Substantiated Art of Teaching



Education

- Teaching practices (pedagogy)
- Methodology
- Content subject matter
- Age group knowledge
- Classroom management
- Differentiation
- Planning
- Assessment
- Educational research
- Educational philosophy
- Educational technology

Neuroscience

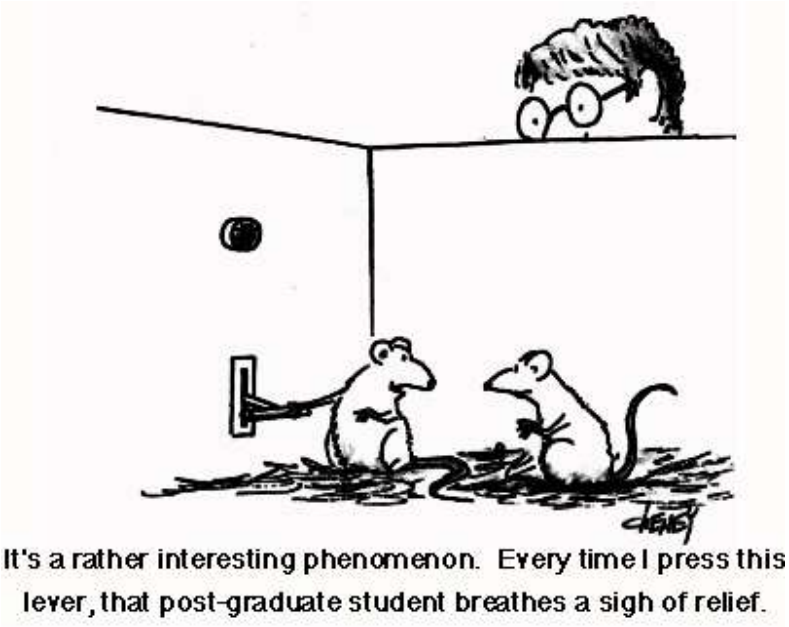
- Nervous system
- Brain
- Neurons
- Synapses
- Neurotransmitters
- Neural networks
- Sensory systems
- Motor control
- Learning
- Memory
- Cognition
- Arousal mechanisms

Psychology

- Consciousness
- Perception
- Emotion
- Personality
- Behavior
- Cognition
- Interpersonal relationships

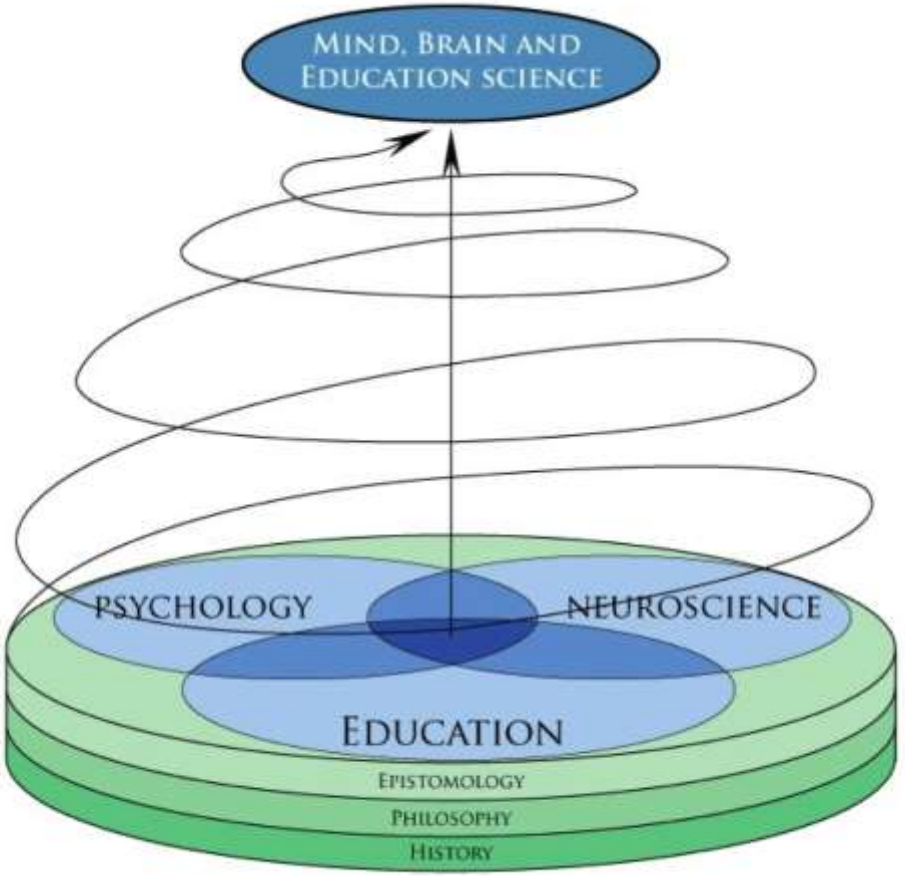
"Mind, Brain, and Education scientist":

- In some instances this label will mean ***teachers*** who are integrating cognitive neuroscience and psychological foundations into their practice.
- In other cases it will mean ***psychologists*** who seek to bridge the hard and soft sciences.
- In yet others it will mean ***neuroscientists*** who dare to bring laboratory findings into the classroom.



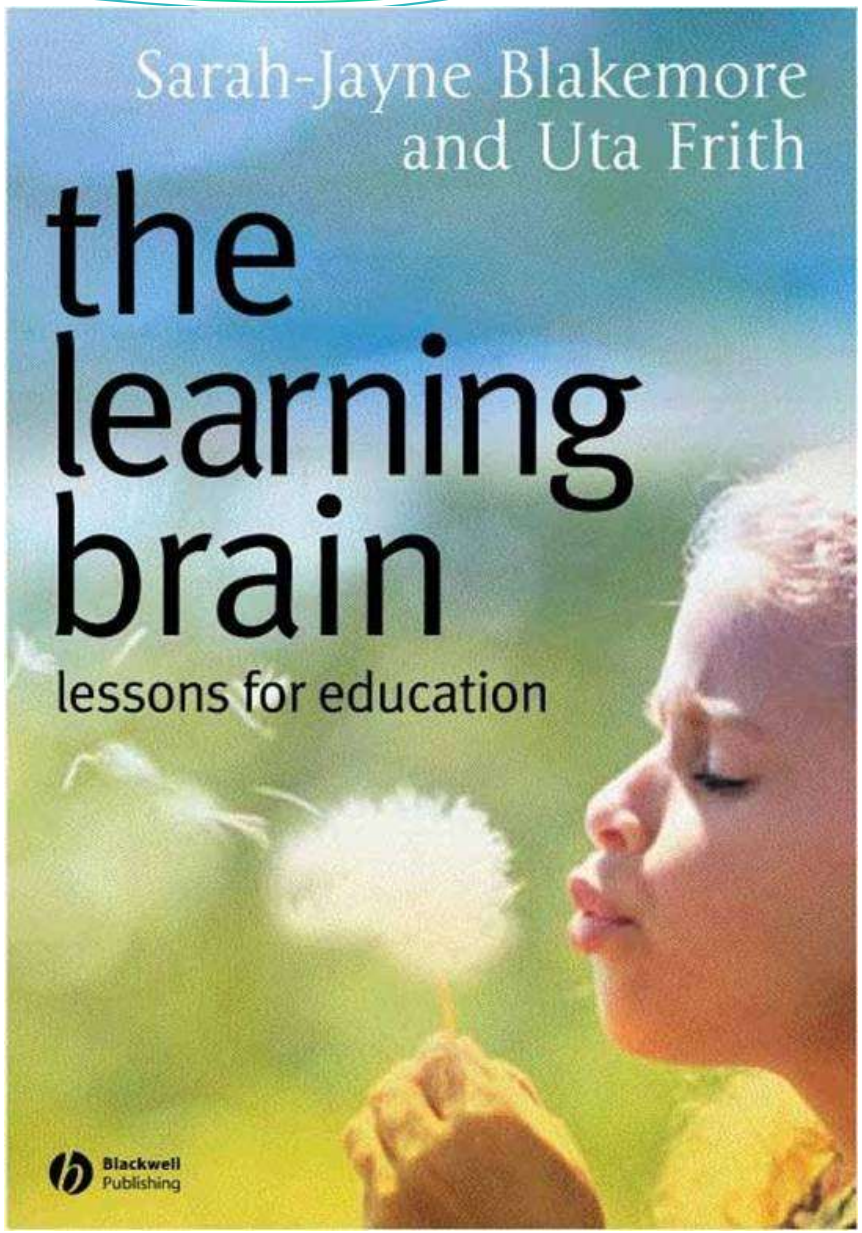
"Mind, Brain, and Education scientist":

- Work as a "purist" is not any less valuable than work in the transdisciplinary discipline of MBE science; it does, however, **acknowledge the need for new professionals who speak the language, walk the talk, and can work seamlessly as MBE specialists** as well.

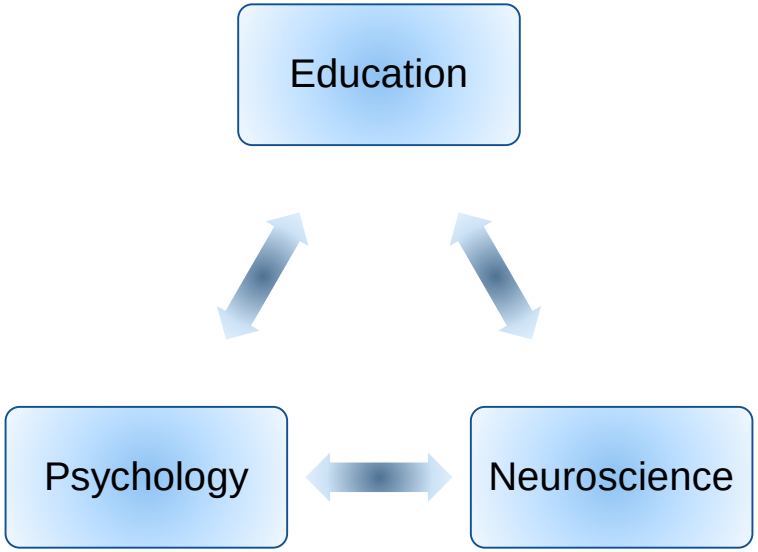


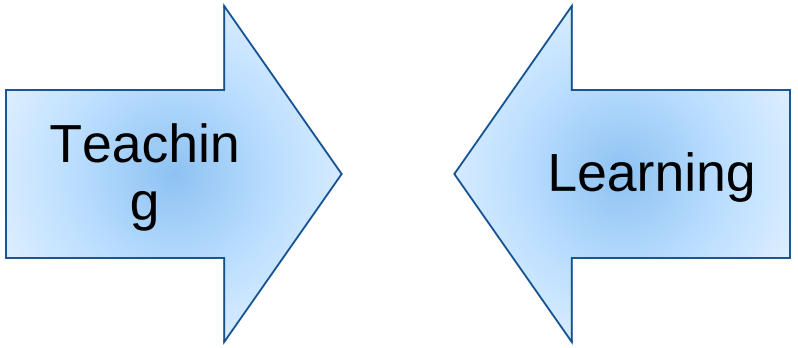
MBE: Balance between learning and teaching

- "We know a little of what goes on in the brain when we learn, but hardly anything about what goes on in the brain when we teach," (Blakemore & Frith, 2008, p.118).



Equal balance in MBE





Premises

1. The new academic discipline in discussion is the intersection of neuroscience, education and psychology.
2. The focus is equally balanced between knowledge of how humans learn and how best to teach.
3. Education is not a “one-size-fits-all” practice (recipe approach).
4. The first rule of Education is the same as that of Medicine: “Do no harm.”

Bias

- I am a teacher, working hard to be an MBE scientist.
- I believe the ultimate goal of education is to form critical thinkers (not to memorize curriculum content).
- Professor of Education and Neuropsychology at the *Universidad San Francisco de Quito*.
- Promoter of the International Mind, Brain, and Education Society.

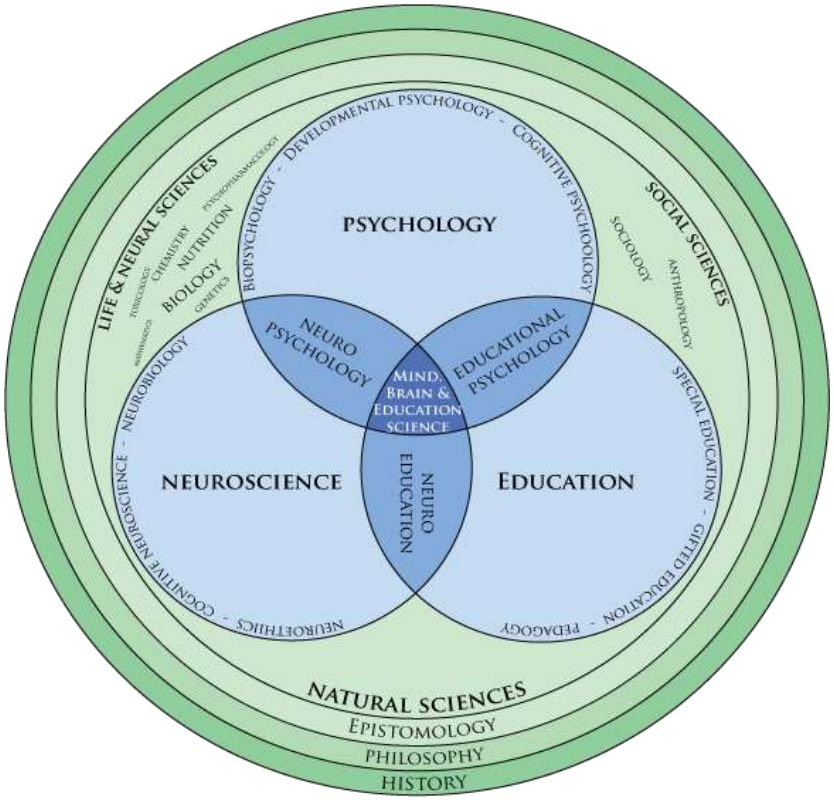
Why is MBE needed now more than ever before?

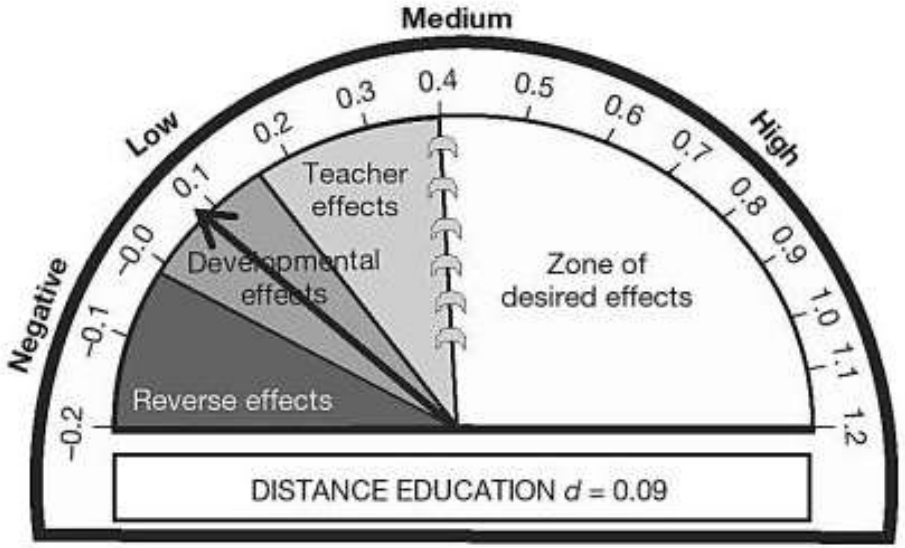
- Begin with the premise that solutions to problems in education today require the more sophisticated and complex approach offered by MBE science.
- Despite more than 125 years of good intentions to resolve the question “How should we teach to best serve student learning?” we still don’t have the answer.
- The brain is the most complex organ on earth; solutions to educational difficulties are not easy.

Before: Neuroscientists “enlightened” Teachers

Now: From the classrooms to the labs and back (Teachers and Neuroscientists mutually inform one another; Psychologists often intermediate)

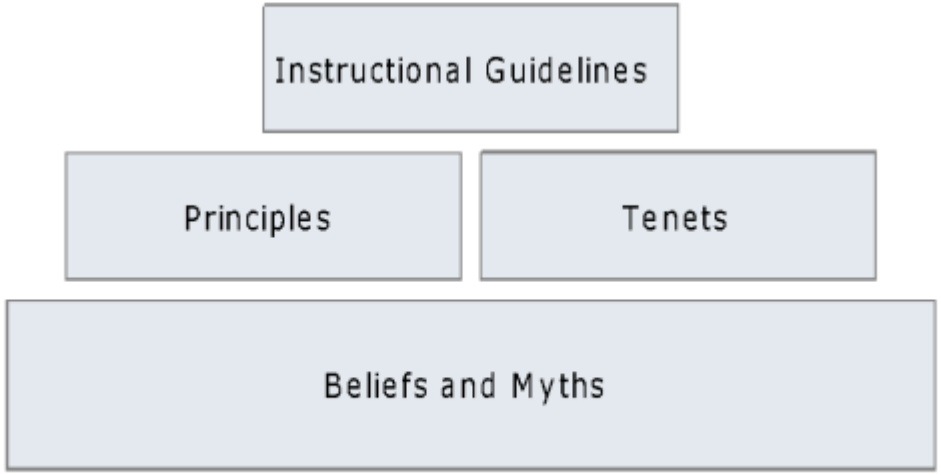
Mind, Brain, and Education science combined with Visible Learning in a professional development format



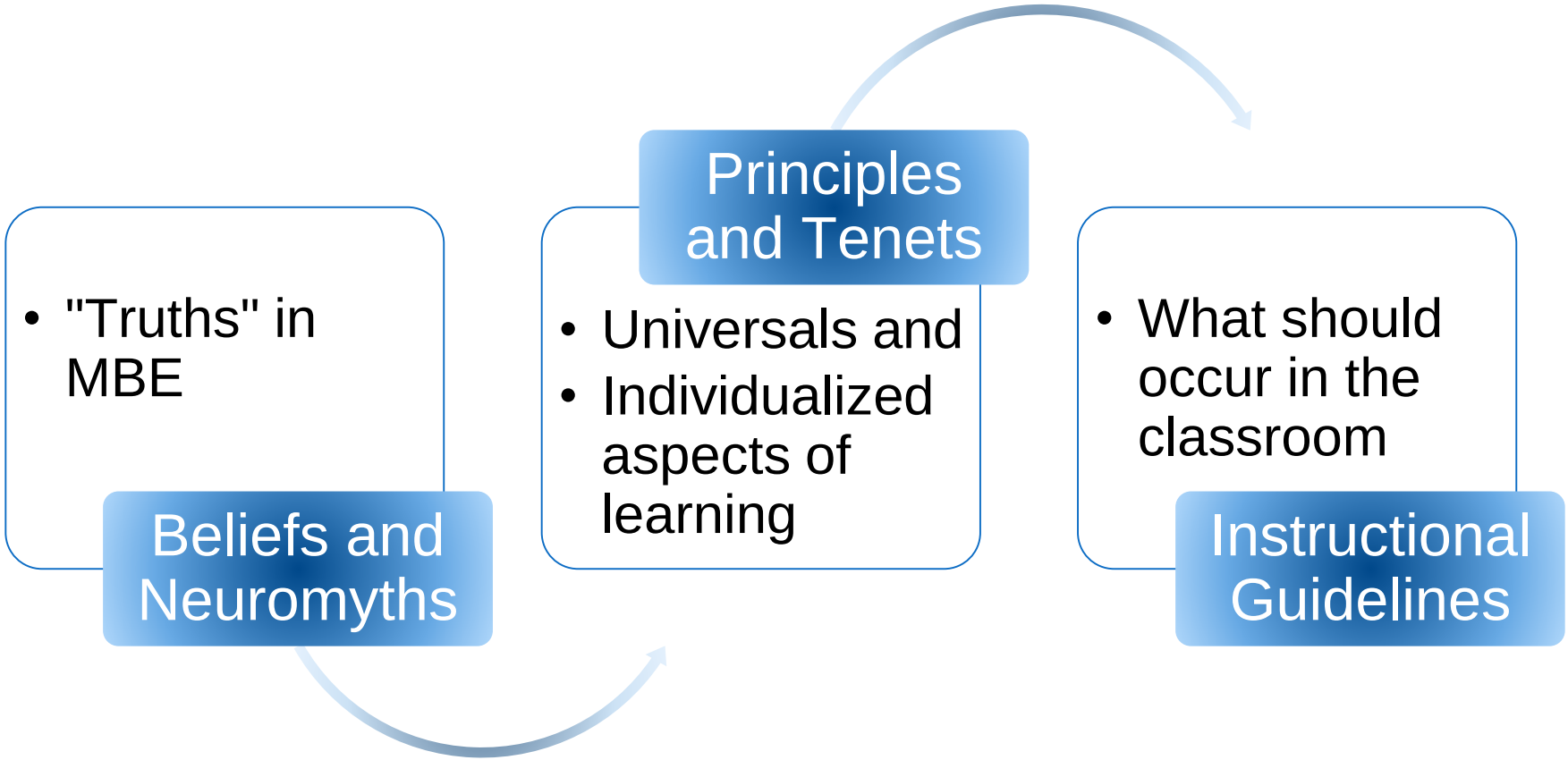


Level 1: Novice	Level 2: Advanced Beginner	Level 3: Proficient	Level 4: Excellent	Level 5: Expert or Master	
					Fundamental
					Deep

The New Model:

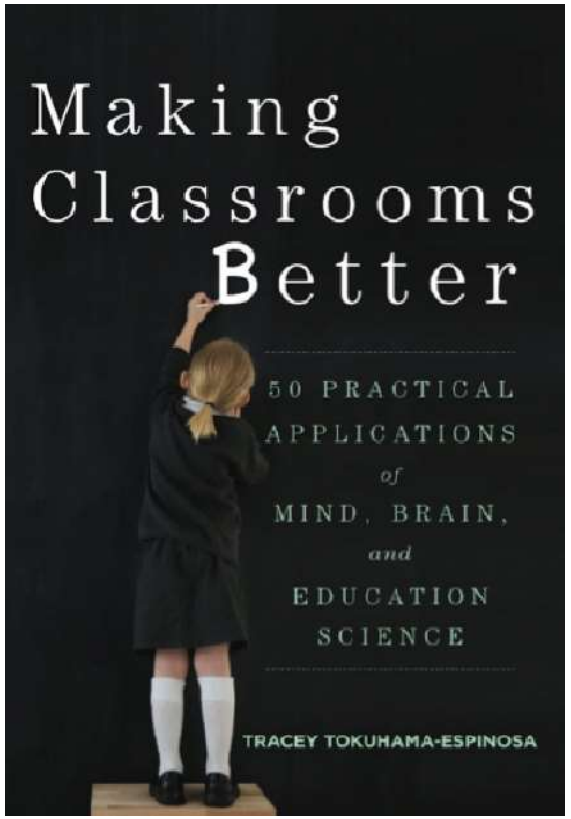


- The categorization of concepts (**neuromyths** to the **well-established beliefs**) agreed upon by the Delphi expert panel pointed to the main tenets and principles of Mind, Brain, and Education science.
- **Tenets** are relative to each **individual learner** while the **principles** are important in the **same way for all learners**.
- The tenets and principles define the **instructional guidelines** of the field.


"Truths" in MBE
Beliefs and Neuromyths
Principles and Tenets
Universals and
Individualized aspects of learning
What should occur in the classroom
Instructional Guidelines

Approaching the information in an orderly manner:

50 classroom interventions that improve student learning based on MBE+Visible Learning

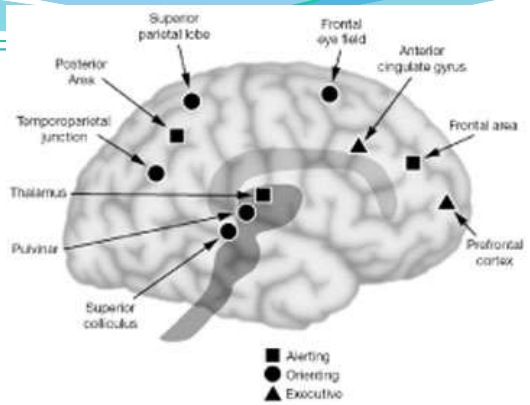


Filters to Elect the Best Planning, Evaluation, and Activities

Key premise:

- Memory+Attention=Learning?
- (Oversimplified, but…) TRUE! Without Attention and Memory there is no Learning
- To learn something new means you have to pay attention to it as well as remember it.

Best Classroom Practice 1. Plan Activities That Grab Attention



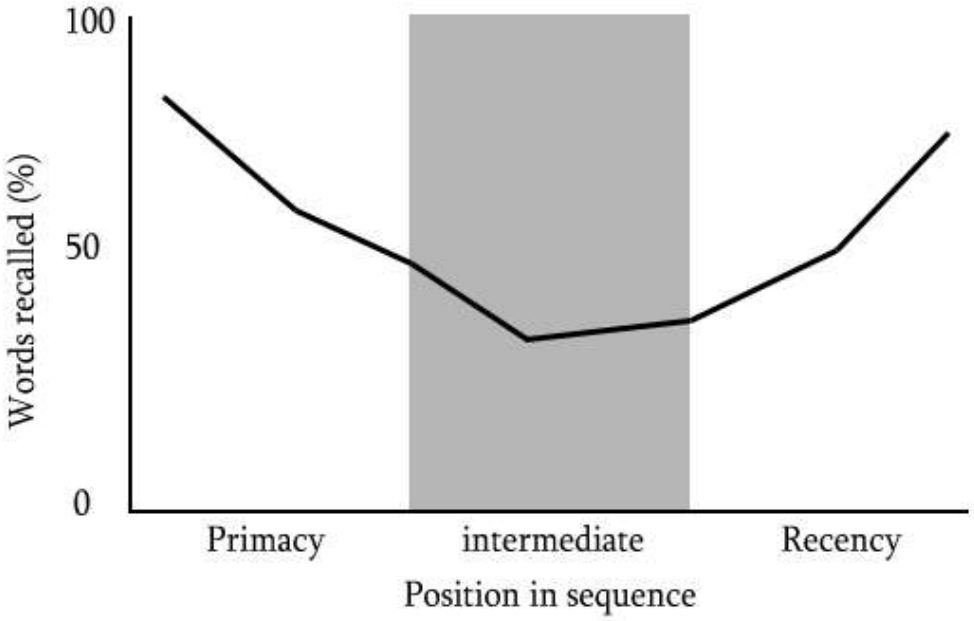
- Attention Systems (Posner, 2011)
  - The ***orienting system*** allows an individual to place herself in time or space relative to others or the target stimulus.
  - The ***alerting system*** allows an individual to know when to keep her guard up against perceived threats or to stay on the lookout for rewarding situations.
  - The ***executive functioning systems*** are particularly vital to learning, as they help a person decide what's "important" and deserving of the brain's focus.
- The value of active learning can be explained by the fact that it's impossible for a student not to pay attention when she's the center of attention.

- This is important to know, because teachers need to plan activities that help them strengthen all of the different networks associated with each learning task. Just getting the kids' attention on entering class (**alerting system**) isn't enough.
- **It is impossible for the brain not to pay attention; it is always paying attention to something** (Koenig, 2010).
- **Human learning involves both focused attention and peripheral perception.** The main teaching takeaway here is that it's difficult for many students to know what exactly is important.

- If a student is not sure of the learning objective, she may pay attention to irrelevant aspects of the activity and therefore fail to learn.
- Setting clear learning objectives allows learners to know what they need to do and thus become more autonomous.
- Because learners often lack the instinct to intuit the desired focus of the class's attention, teachers must explicitly call attention to the important parts of the class.

- One’s attention level is based on the affect accompanying the situation: Better affect equals better attention and better learning (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011).

“Primacy-Recency”



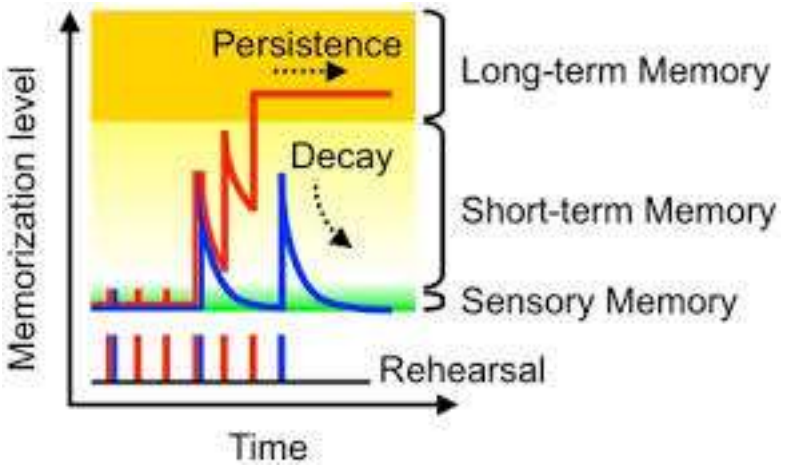
The Primacy-Receny Effect

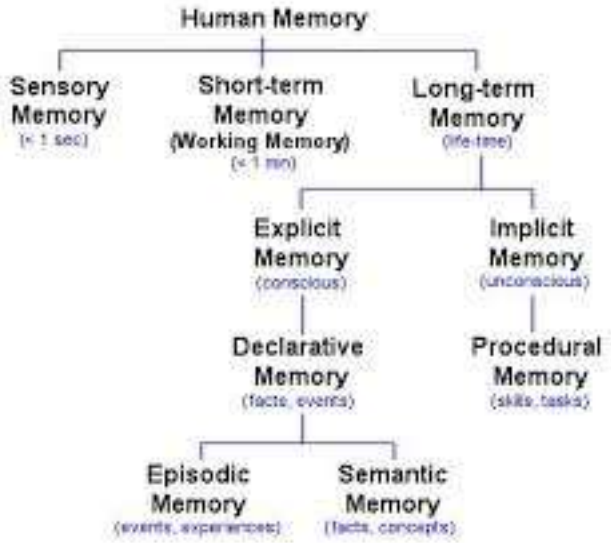
- People remember best what happens first, second best what happens last, and least what happens in the middle.

Best Classroom Practice 2. Plan Activities That Stimulate Memory

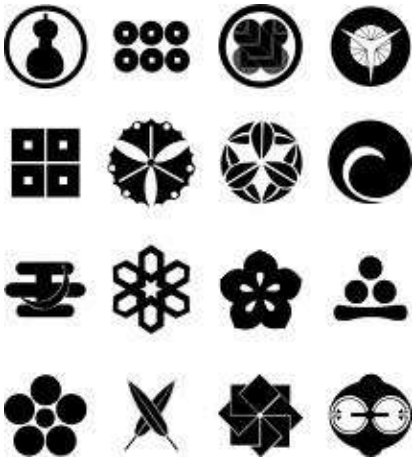
- **All learning occurs through sensory perception** (Jarvis, 2012). Research indicates that after we see, feel, hear, smell, touch, or taste something, this perception enters the brain.
- It stops first at the amygdala (to check for threats) then, after a momentary stop in the frontal lobes, it enters the hippocampus (to confirm information stored in declarative memory)—two areas that are important in new memory processing (Freeman, 1991).

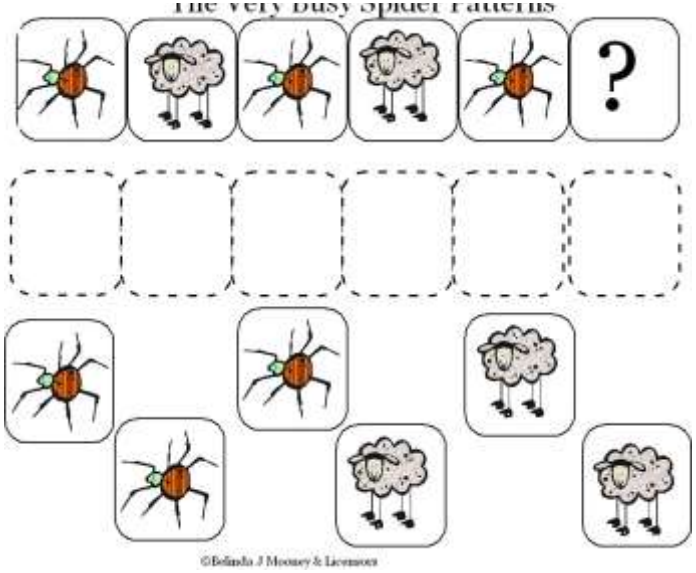
- Levine (2002) divides memory into varying neuronal circuits, including **short-term** memory (which relates to recoding information into intelligible terms), **emotional memory**, and **active working memory** (keeping ideas in mind, as well as short- and medium-term planning and linking short- and **long-term** memories to complete the process) (Baddeley, 2003).



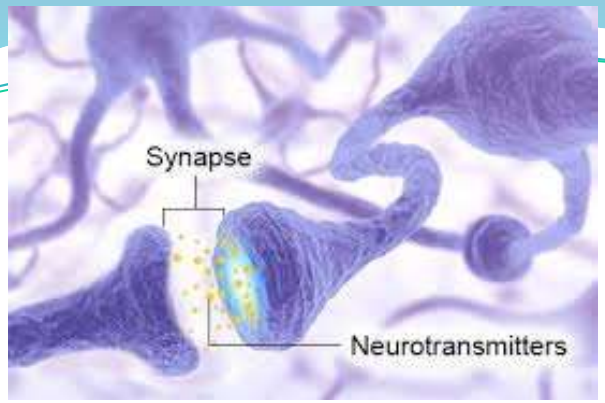


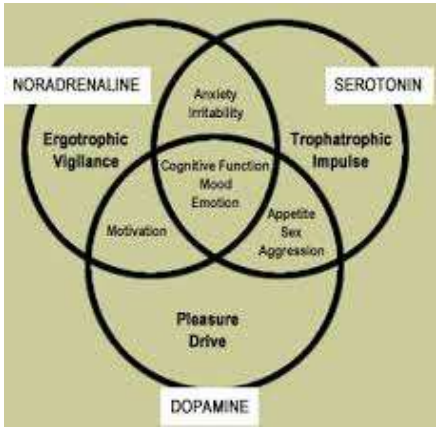
- **All new learning passes through the filter of prior experiences** (Lewis & Williams, 1994; Tokuhama-Espinosa, 2008), which helps the brain work efficiently.
- As **the brain is primed to detect patterns** (for an example se Vandenberghe et al., 1996) as well as novelty (see Knight, 1996), sensory perception is first reviewed in the brain through the filter o memory.
- If the brain recognizes some type of pattern already in memory, it compares the new and the old to determine what information might be missing for new learning, which is why association works well in schools. **If there is nothing recognizable, the brain detects novelty.**



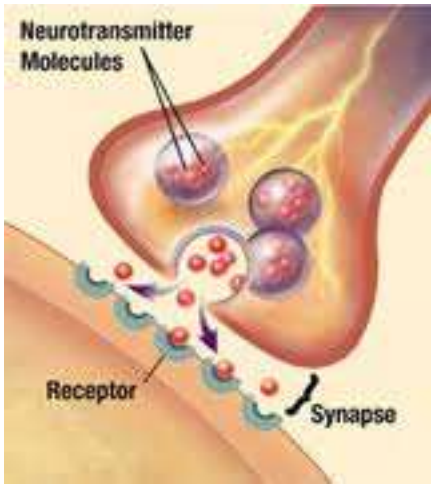


- Novelty detection highlights similarities and differences of known concepts, also permitting new learning.
- Research shows that the brain actually craves novelty (Biederman & Vessel, 2006), which explains why some students become easily bored in class when the same things occur every day.

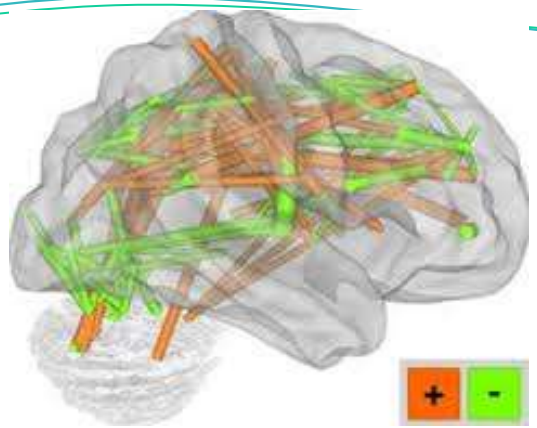


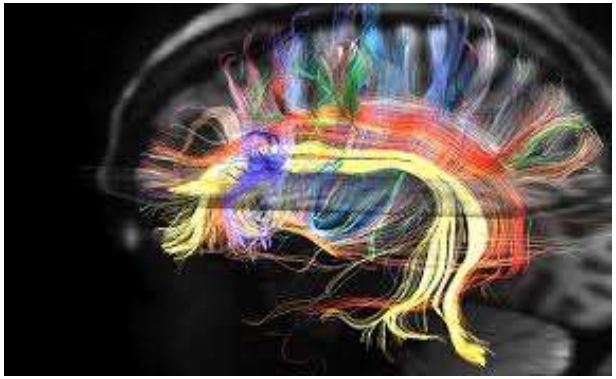


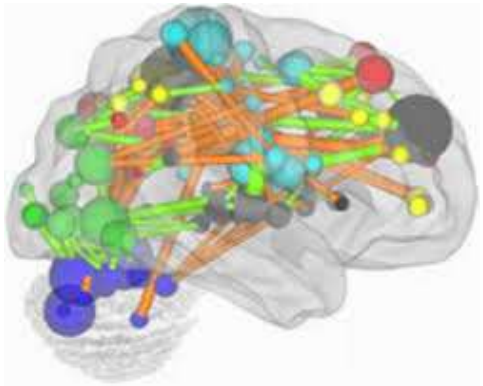
- Memory processes are mediated by chemicals and depend on specific neurotransmitters.
- These neurotransmitters become active depending on emotional states.



List of Neurotransmitters	
Type	**Transmitter**
Amines	Acetylcholine
	Serotonin
	Dopamine
	Norepinephrine
	L-Dopa
Amino Acids	Tryptophan
	GABA
	Glycine
	Tyramine
	Glutamate



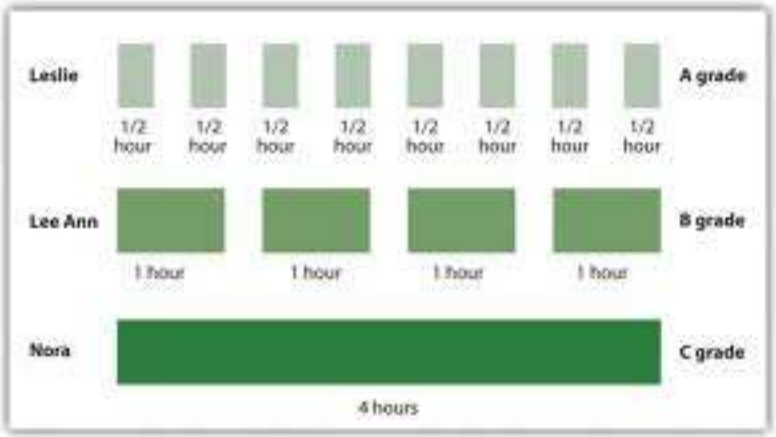




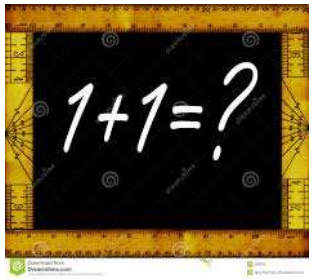
- When we use a variety of methods to learn something, we are putting the same information in our brain in slightly different neural pathways.
- This means that locating the information for later retrieval will be easier, because there are now a variety of ways to reach it.

Best Classroom Practice 3. Plan to Use Spaced Versus Massed Learning Moments

- Memory is enhanced by spacing the introduction of concepts (separating learning moments by long or short periods of time and large or small amounts of content) as opposed to massing them together (Enikö et al., 2012; Grote, 1995; Izawa, 1971; Murphy & Miller, 1956; Roediger & Butler, 2010; Seabrook & Brown, 2005; Son, 2004).



- Teachers who plan to revisit a concept several times over the course of the year ensure that memory networks are reinforced over time. The failure to revisit concepts over the course of the year means that we don't take advantage of spaced learning (Cain & De Veri, 1939; Callan & Schweighofer, 2010).
- When teachers fail to reinforce concepts, various memory pathways are weakened, and without memory, there is no ability to retrieve the concept or to demonstrate real new learning.



- Revisiting ideas and concepts solidifies understanding.
- The harder the learning task, the more time and space needed between learning moments.

$$1\frac{2}{3} \times\tfrac{4}{4} = \frac{8}{12} \quad 8 \text{ 12ths}$$
$$\text{plus}$$
$$7\frac{5}{6} \times\tfrac{2}{2} = \frac{10}{12} \quad 10 \text{ 12ths}$$
$$\text{plus}$$
$$+9\frac{3}{4} \times\tfrac{3}{3} = \frac{9}{12} \quad 9 \text{ 12ths}$$
$$\text{equals}$$
$$17 \text{ plus } \frac{27}{12} \quad 27 \text{ 12ths} \quad 19\frac{1}{4}$$

$$12\overline{)27} = 2\frac{1}{4}$$
$$\frac{24}{3} \quad \frac{3}{12} = \frac{1}{4}$$

$$\frac{\partial^n \operatorname{agm}(a,b)}{\partial a^n} = \operatorname{agm}(a,b)\delta_n + \frac{n}{4^n}\left(\frac{\partial \delta_{n-1}}{K\left[\frac{a-b}{a+b}\right]} + \cdots\right)$$

$$\sum_{k_1=0}^{n} \sum_{k_2=0}^{n-k_1} \cdots \sum_{k_{p-1}=0}^{n-\sum_{j=1}^{p-2} k_j} \left(\prod_{j=1}^{p-1} \binom{n-\sum_{i=1}^{j-1} k_i}{k_j}\right) \left(\prod_{j=1}^{p} A(k_j, a, b)\right) A\left(n-\sum_{j=1}^{p} k_j, a, b\right)$$

$$(a+b)(a+1)! \sum_{q=1}^{n} \frac{(-1)^q}{(q+1)!(n-q)!} K\left(\left[\frac{a-b}{a+b}\right]^2\right)^{n-q}$$

$$\sum_{k_1=0}^{n} \sum_{k_2=0}^{n-k_1} \cdots \sum_{k_{p-1}=0}^{n-\sum_{j=1}^{p-2} k_j} \left(\prod_{j=1}^{p-1} \binom{n-\sum_{i=1}^{j-1} k_i}{k_j}\right) \left(\prod_{j=1}^{p} A(k_j, a, b)\right) A\left(n-\sum_{j=1}^{p} k_j, a, b\right)$$

$$A(n,a,b) = A\left(\left[\frac{a-b}{a+b}\right]^2\right)\delta_n + \frac{n}{2}\sum_{m=1}^{n-1} \frac{1}{m!} \sum_{j=0}^{m} \frac{1}{(m-j)!\,2^{m-j}} \left((2j-m+1)_{2m} \left[\frac{a+b}{a-b}\right]^{2j}\right.$$

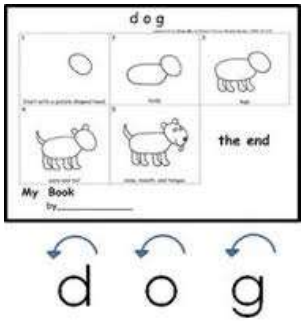
$$\left. {}_2F_1\left(\frac{1}{2}, \frac{1}{2}; 1-n; \left[\frac{a-b}{a+b}\right]^2\right) \sum_{q=0}^{m} (-1)^q \binom{m}{q} \left[\frac{a-b}{a+b}\right]^{2q} \sum_{k_1+\cdots+k_{2^q}=n} \sum_{k_1,\ldots,k_{2^q}} \cdots \sum_{k_{2^q-1}=0}^{n} k_1 \cdots k_{2^q} a_{k_1} \cdots a_{k_{2^q}} \right)$$

$$(a_1+a_2+\cdots+a_{m-q})_n (a_1,a_2,\ldots,a_{m-q}) \prod_{i=1}^{m-q} \left(\delta_{a_i} - \frac{2(-1)^{a_i}(a_i)^{a_i-1}a_i!}{(a_i+b)^{a_i-1}}\right) : n \in \mathbb{N}$$

Best Classroom Practice 4. Plan to Incorporate Repetition

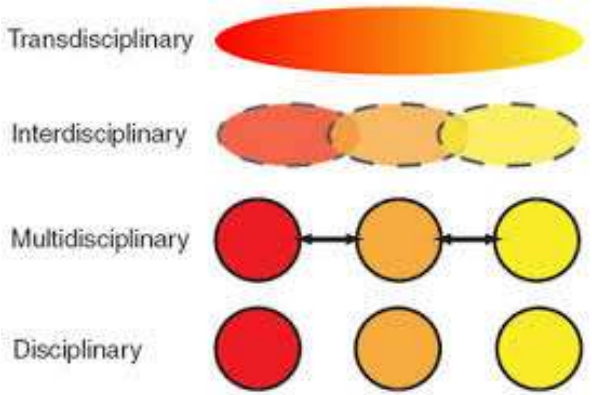
- Repeating a concept or idea, silently or aloud, over a long period of time helps future recall of the concept.
- Both mental imagery and verbal encoding assist memory (and therefore learning). Pavio believed (he was later proved correct) that verbal associations and visual imagery are conducted within two different neural networks and thus complement each other when unified (Pavio, 1971, 1990).

- This means that seeing something written *and* hearing it reinforces learning because they are distinct neural pathways that reinforce the same concept or schema.
- **When we try to remember new information, we repeat it over and over, either out loud or in our heads**.
- Strengthening these networks actually results in an enhanced myelin sheath between neurons, which is why retrieval is faster.

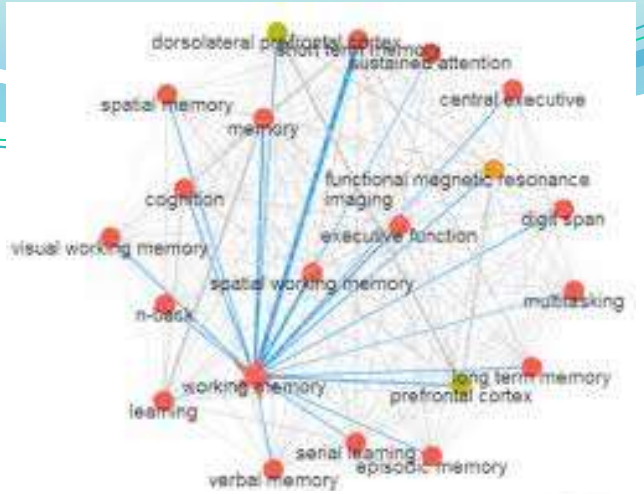


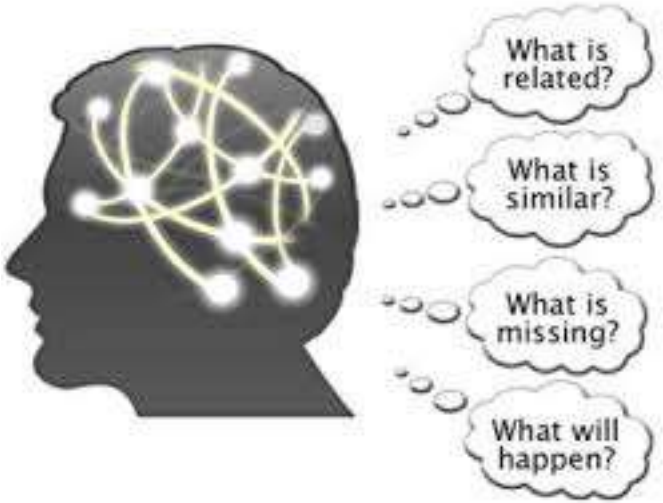
Best Classroom Practice 5. Take Advantage of Variation and Transdisciplinarity

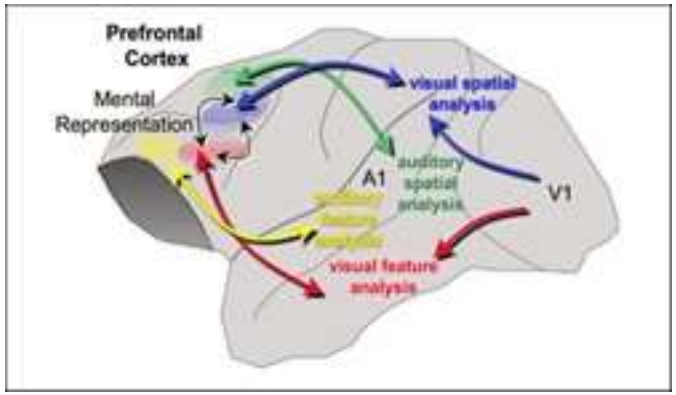
- Varying the way a concept or idea is rehearsed also helps recall.
- Saying something to ourselves over and over is effective, but saying it over and over *and* writing it down is even more effective.
- And it's even *more* effective to say it, write it, and then make a mind map of it.
- Better still is saying it, writing it, making a mind map, and then teaching it to someone else, and so on.



- **Teaching to different memory systems reinforces different neuronal networks and thus enhances recall** (Squire, 1992ª, 1992b; Squire & Kandel, 2008).
- Classes that rely on a simplistic delivery of information by a teacher or on copying notes will not be as successful as classes that find ways to space information over time in a variety of ways.
- Students who discuss class content (talk), review their notes (read), rewrite and summarize, read, and watch videos on the topic will put the same information in their brains in slightly different neural pathways, allowing for more efficient recall.



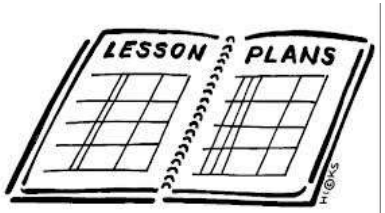


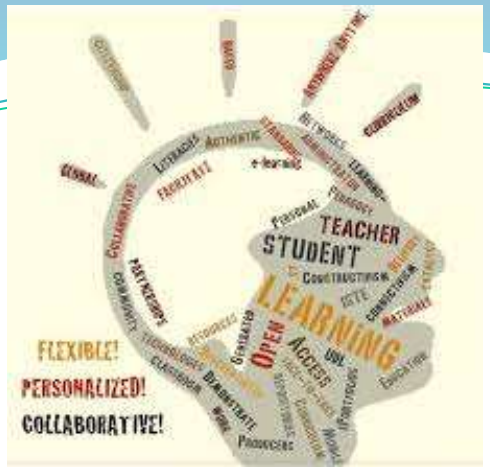


- There is evidence that most exchanges in classrooms are linguistic and orally conveyed, which challenges students who don't pick up on these auditory cues as well as they should.
- According to the Northwest Regional Educational Laboratory (2005), "**All the senses come into play in learning**.
- Teaching the same concept through different disciplines reinforces the variety of ways a concept is remembered, or transferred to long-term memory (and therefore retrievable) (Bernsen, 1994).

Best Classroom Practice 6. Plan Authentic Lessons

- We are trained in teacher education schools to make sense of the material—put it in a logical order and structure lessons within a specific time frame—but we are often not guided in how to give the material meaning to the individual students in our classroom.
- One of the most time-consuming aspects of learning relates to planning activities that connect with each individual learner.



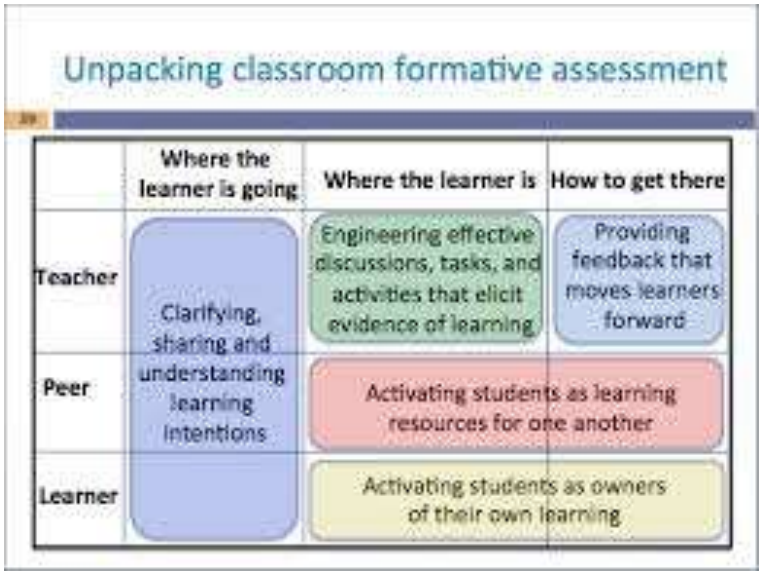


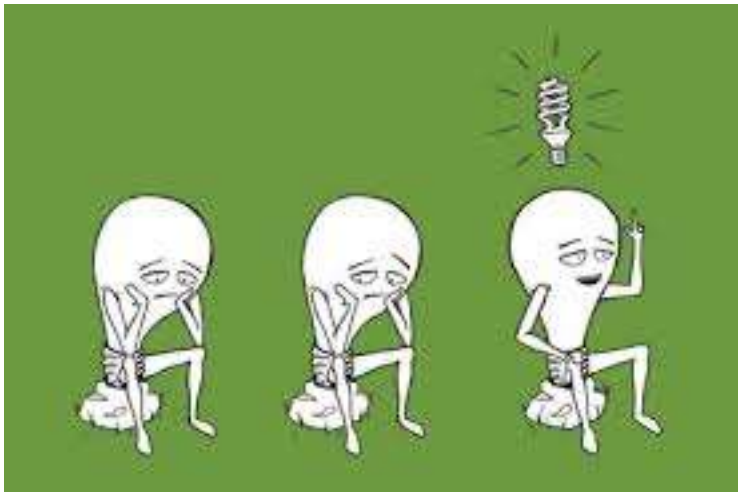
- To make lessons authentic, teachers must devote enough time to planning that recognizes cultural contexts and individuals' past experiences.
- Making a lesson authentic to learners is a difficult task because it presumes knowledge of students' past experiences.
- To plan an authentic lesson, a teacher must know her audience well.
- Authenticity can be judged at a cultural level as well as at an individual level.

Best Classroom Practice 7. Implement Formative Evaluation

- Evaluation, assessment, and feedback are some of the most important yet most controversial aspects of student learning.
- “Learning” implies that you didn’t know something before; if you weren’t previously ignorant of the knowledge you have acquired, it doesn’t count as learning.

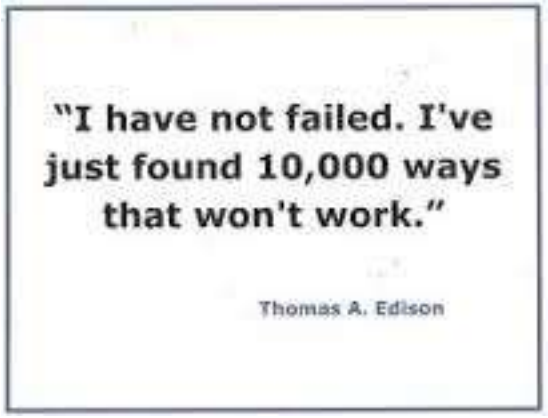
- **The classrooms that employ formative assessment in the best possible ways are those in which both teacher and student learn from continual, conscientious, quality feedback**.
- Formative assessment means that evaluation and activity are one and the same: Classroom activities actually lead to assessment of some kind. For example, debate, class projects, research, case studies, and Problem Based Learning can be activities as well as grading tools (Brown & Gerhardt, 2006).





- Since learning is based in part on the brain's ability to self-correct (see MBE principle 8), teachers should take advantage of the important role that feedback plays in helping students understand what they don't know and teach to those weaknesses.
- Learning doesn't happen when we already know (or think we know) something, only when we realize we don't know it.
- Brains are highly plastic and develop throughout the lifespan, which means they can continually adapt and restructure connections based on new experiences.

- If there was one lesson about evaluation that should be emphasized far more in modern education, it would be **the need to celebrate errors** because they are evidence of thinking (albeit incorrectly).
- To really be able to do this, however, we need to remember that “good learning environments are made, not found” (MBE instructional guideline 1).



Best Classroom Practice 8. Use Product, Process, and Progress Evaluations

- Breaking evaluation schemes down into “products,” “processes,” and “progress” measures, as suggested by Guskey (1996, 2001, 2011), helps students understand where they need to improve, keeps motivation high for learning even if they receive low grades, and shows them that the teacher takes a personal interest in their stages of learning.

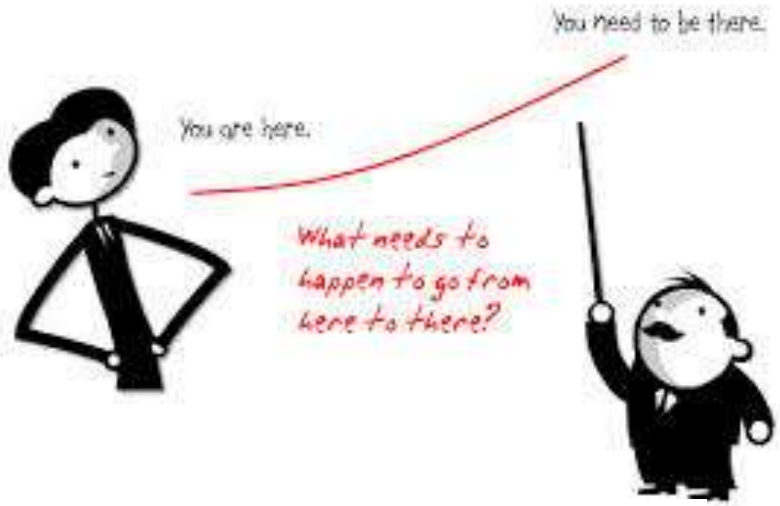
- A **“product”** is what most teachers typically evaluate: a test, a final project, a pop quiz, an essay—in other words, a task or product in a single defining moment. Product evaluations are usually summative.
- A **“process”** evaluation breaks down the steps a student took to arrive at the product. A process evaluation can indicate that a student reached her product the wrong way (for example, by downloading an essay from the Internet as opposed to writing it herself).
- A **“progress”** evaluation is the hardest to administer, because it requires the teacher to know where the student began and where she is now so that he can chart her growth in learning.
- Product, process, and progress evaluations should be an ongoing part of a teacher’s interaction with his students.

Best Classroom Practice 9. Test to Improve Learning

- While summative evaluations should not make up the lion's share of evaluation techniques, it might seem ironic to note that **frequent testing may lead to improved learning** (Glass, Ingate, & Sinha, 2013; Pyc & Rawson, 2009; Roediger & Karpicke, 2006).
- This is easier to understand when it is clear that it is not the testing *per se* that enhances learning, but rather **the forced retrieval of information** (Karpicke & Blunt, 2011; Keresztes, Kaiser, Kovács, & Racsmány, 2013) that occurs when practicing for a test due to **elaborates mechanisms for linking information cues to targets** (Pyc & Rawson, 2010).

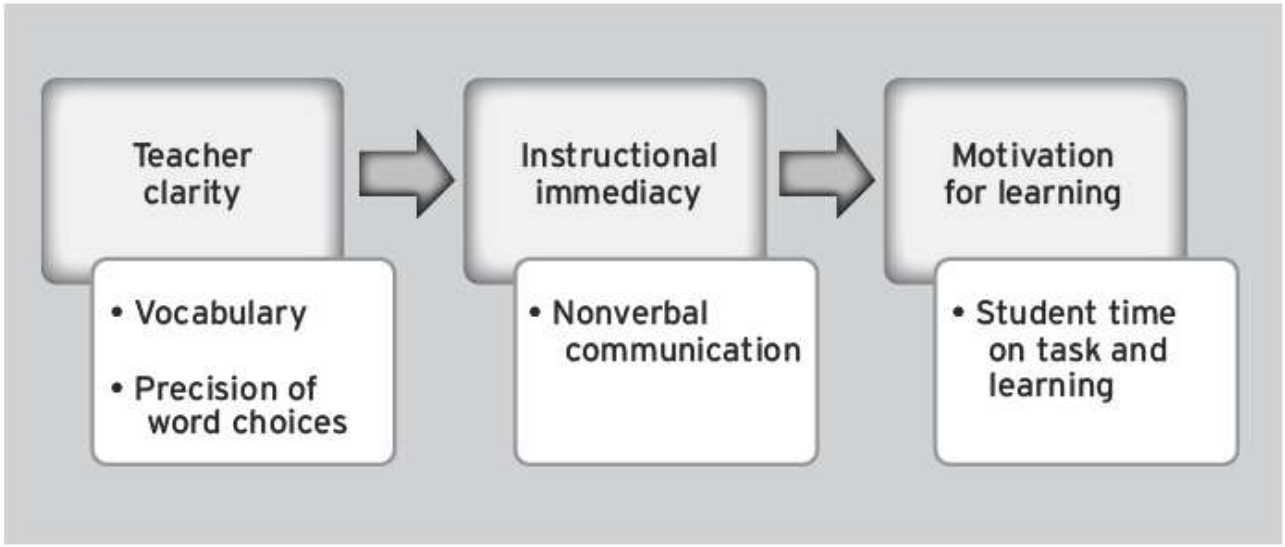
Best Classroom Practice 10. Develop Shared, Explicit Learning Objectives

- Shared, explicit learning objectives keep everyone on the same page and improve the chances of success. Wiggins and McTighe (2005) have suggested an idea borrowed from business:
- Begin with the end in mind. Where do we want to be at the end of the lesson? By clearly identifying where you want to go, you ensure smooth sailing toward your target, mastery learning.



- Clearly stating objectives provides students with unmistakable direction for their learning (Marzano, 2009) and increases the likelihood that teachers will achieve their learning goals.

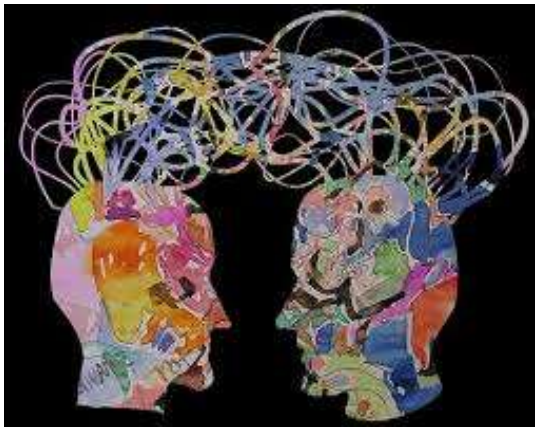
Student Motivation Is Linked to Teacher Clarity



- Anita Archer and Charles A. Hughes (2010) believe that explicit instruction is the key to effective and efficient teaching due to the shared objectives they provide. **It is in human nature to enjoy success; no one likes failure**.
- Humans are good at **modeling behavior**, and when they are given a clear model and opportunities to practice, they are able to replicate what they observe.
- “SMART” acronym (**s**pecific, **m**easureable, **a**ttainable, **r**elevant, and **t**imely) is an excellent guide

Best Classroom Practice 11. Strive for Clarity and Immediacy

- Teacher clarity ensures that the students understand the focus of the lesson as well as the path toward successful learning—in other words, there is no guessing about what is acceptable as "good work" (Simonds, 2007).
- **Clarity of speech** is fundamental to ensuring that students have good examples and appropriate guided practice, and that they understand how and why assessment will occur (Cheseboro & McCroskey, 1998, 2000, 2001).

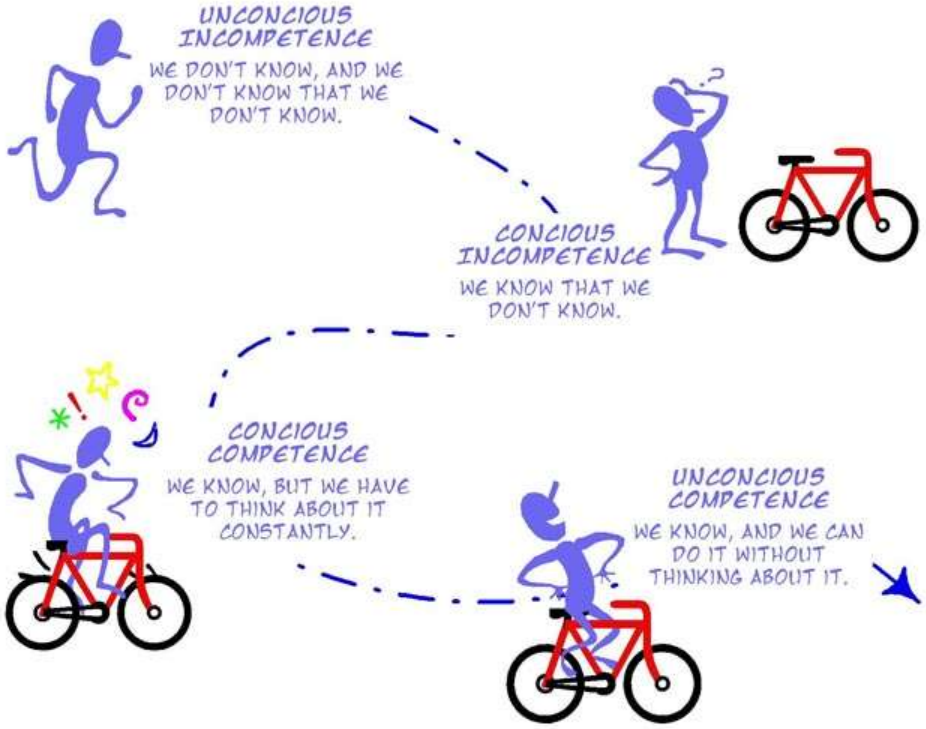


- According to Cheseboro and McCroskey, a teacher's verbal clarity can be broken down into several subareas, such as **fluency, precision,** and **class structure** (as in course organization, including transitions within in class activities).
- Parameters of a teacher's nonverbal communication include the **time spent covering a topic, speaking pace, body movement, and instructional immediacy** (Cheseboro & McCroskey, 1998).
- The use of **precise vocabulary** improves learning outcomes because it facilitates the explicit communication of goals.

- Teacher clarity, relevance, caring, and verbal aggressiveness have been shown to impact student responses to learning, for better or for worse, especially their receptiveness to new information (see Zigarovich & Myers, 2011).
- When students perceived their teachers to be clear, relevant, and caring, the impacts were positive; when they perceived a teacher to be aggressive, they shut down and their learning was impaired.

Best Classroom Practice 12. Provide Feedback for Mastery Learning

- Feedback that delivers formative evaluation plays a huge role in learning. When we learn what others think about our thinking (what a teacher thinks about how well we resolved a problem, for example), our own thinking processes are changed and refined through that feedback (Popham, 2013).



Best Classroom Practice 12. Provide Feedback for Mastery Learning

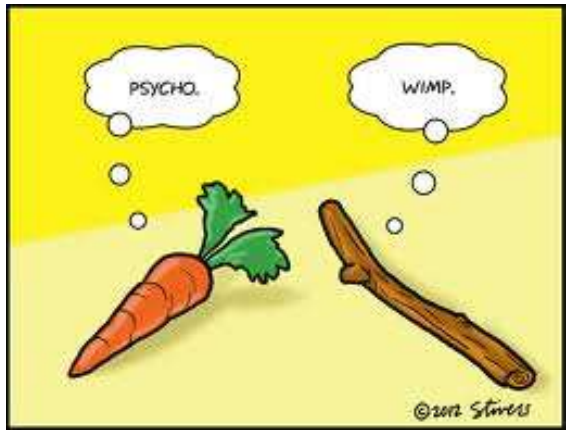
- **Feedback triggers the confirmation, negation, new adaptation, or modification of our mental schema, or mindsets**.
- Feedback on what things we did correctly or incorrectly or ideas about how to improve processes are a key part of learning.

- Depending on our relationship with the person giving the feedback or the signal received, feedback volleys can be a powerful model of learning.
- **Small comments by people in authority (e.g., teachers) can have an amazing impact on the way we think about ourselves as learners as well as the thinking processes we develop throughout our lifetime**.

- Teachers must learn how to apply conscientious, purposeful identification of the right moments to promote **authentic esteem-building** and give **feedback that nurtures growth**.
- However, feedback is a powerful tool only when it is **sincere and based on evidence**. When students perceive praise to be “canned” or rehearsed, it has little effect on their learning, and in fact can raise questions about the teacher’s credibility in their eyes.

- The debate on whether school motivators are better driven by carrots or sticks is still hot.
- Two main pairs of motivators in psychology are positive-negative and intrinsic-extrinsic (Isen & Reeve, 2005; Vallerand et al., 1993).
- People can and do learn in all four combinations (positive-intrinsic, positive-extrinsic, negative-intrinsic, negative-extrinsic), but long-term use and application of new knowledge is enhanced when the learner chooses (positive) to learn for himself rather than having learning forces (negative) on him from the outside (extrinsic) (Isen & Reeve, 2005), though there are variants across the lifespan (Lepper, Corpus, & Iyengar, 2005).

	Positive (+)	Negative (-)
Intrinsic		
Extrinsic		



Best Classroom Practice 13. Nurture Teacher-Student Relationships

- A core MBE principle (number 11) is that "Emotions are critical to detecting patterns, to decision- making, and to learning." If the student doesn't have positive, affective connections to her teacher, her learning is compromised.

- A professor might think he's delivering the right feedback in the word he chooses, but fails to understand that his face, tone of voice and body language are sending another message.
- **The brain is wired to warn us of threats perceived either through facial expressions or tones of voice** (Winston, Strange, O'Doherty & Dolan, 2005); however, the perception of threats is not always completely accurate.
- Ambady and Rosenthal (1994) found that a teacher has just half a minute to establish credibility with learners before they judge whether or not he is competent based on body languages.

"You're doing great."

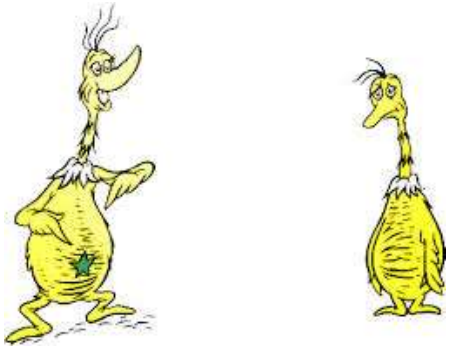
- Hattie (2003) has identified a great difference between teachers who are “expert” and those who are “experienced” in managing how they think about learning, and this is communicated, willingly or not to their students (Kerrins & Cushing, 1998).
- Experts know how to adjust and adapt to challenges in the class—the need for differentiation, disturbance, finding the right methodologies—while “experienced” teachers work solely based on their own contact with teaching experiences (they tend to teach the way they were taught).

- Fostering student effort is often seen as an individual teacher's role, but authors such as Tschannen-Moran and Barr (2004) remind us that **"collective teacher efficacy"** is equivalent to a positive school learning environment and relationships between groups of teachers and students (see also Goldman, Botkin, Tokugana & Kuklinski, 1997) and improves student learning (see also Tschannen-Moran & Woolfolk-Hoy, 2001; Tschannen-Moran, Woolfolk-Hoy, & Hoy, 1998).
- Tschannen-Moran and Barr found that **the collective fostering of student effort actually led to better achievement than individual praise**. That

Best Classroom Practice 14. Believe in the Role of Plasticity and in Your Students

- Aside from the student herself, the teacher is the actor with the most influence over student learning outcomes (Hattie, 2012).

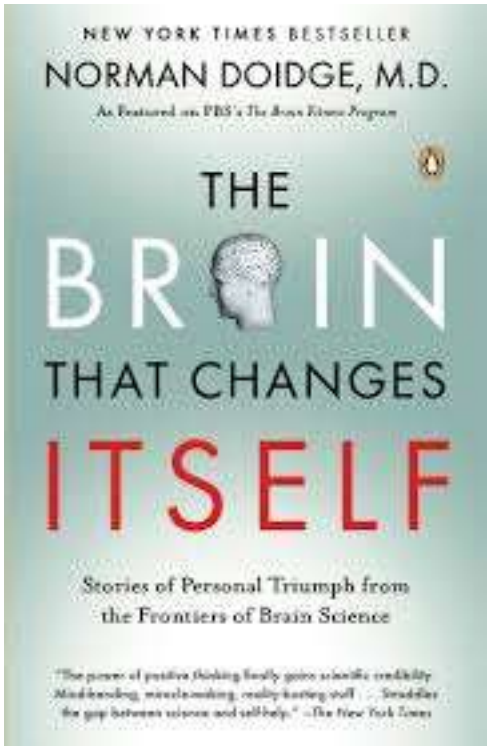
- However, as Hattie points out, **many teachers aren't even aware of their own biases toward their students or about learning processes**.
- Many teachers don't consciously reflect on their beliefs about teaching (what they envision the role of the teacher to be), learning (whether intelligence is fluid or fixed due to genes), evaluation (whether it's an end-of-process event or an ongoing teaching tool, as in formative assessment), and the student (whether their learning potential is rigidly determined by factors such as their genes and socioeconomic status, or whether all students can learn).
- **Students excel when teachers believe their intelligence is ever changing and that their potential can be elevated by the right adjustments to individual needs**.



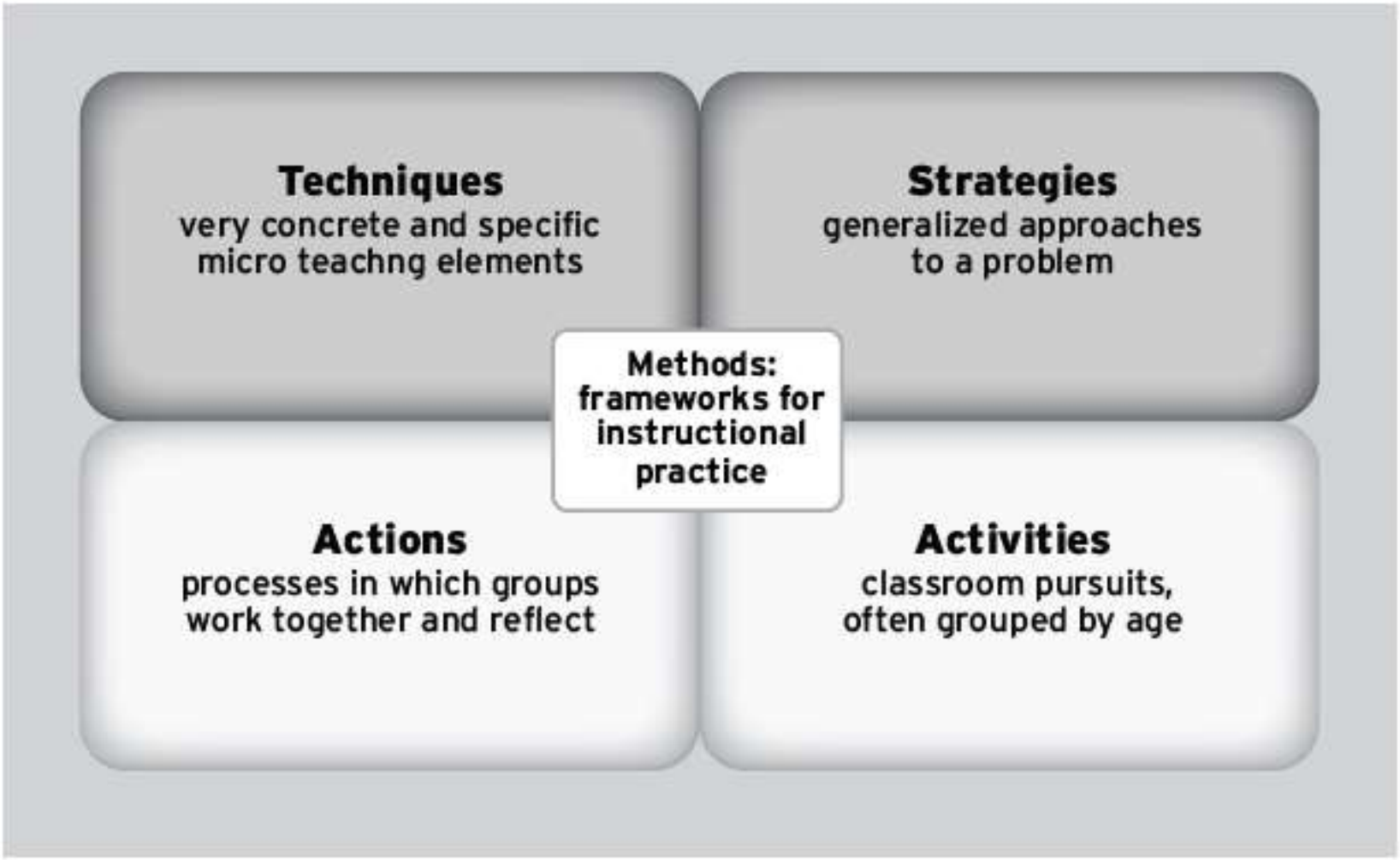
- Students who think their teachers think they can learn, do learn. Students who believe, erroneously or not, that their teachers think their intelligence is inflexible will not even try, and therefore complete a self-fulfilling prophecy.

Norman Doidge
The Brain That Changes Itself

- [These neuroscientists have shown] that children are not always stuck with the mental abilities they are born with; that the damaged brain can often reorganize itself so that when one part fails, another can often substitute; that if brain cells die, they can at times be replaced; that many “circuits” and even basic reflexes that we think are hardwired are not. One of these scientists even showed that thinking, learning, and acting can turn our genes on or off, thus shaping our brain anatomy and our behavior—surely one of the most extraordinary discoveries of the twentieth century. (Doidge, 2008, p. xv)

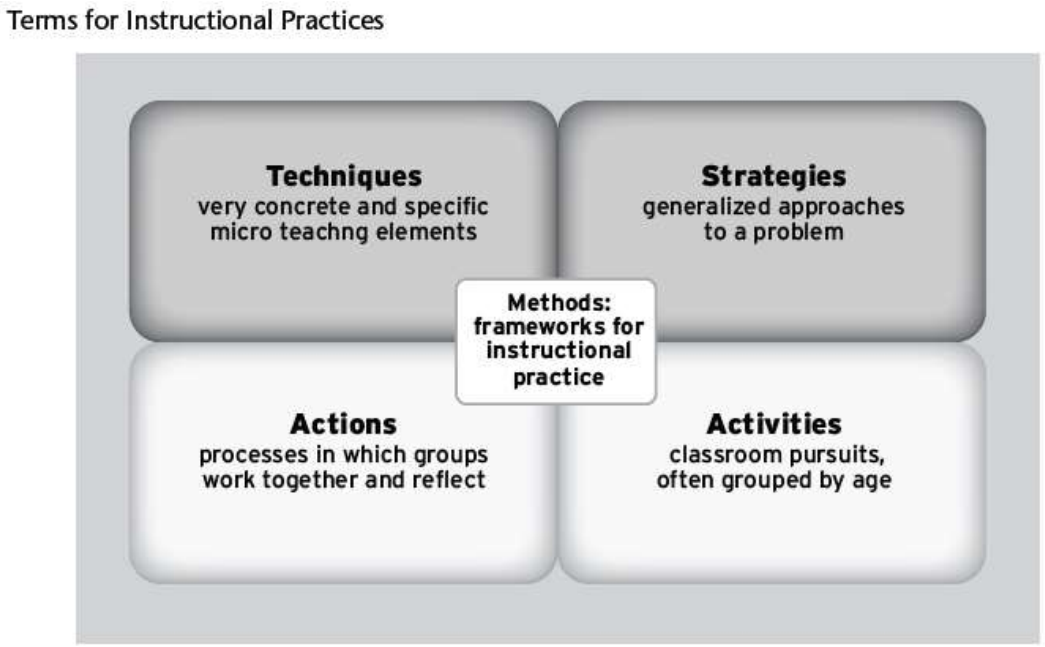


Terms for Instructional Practices



Best Classroom Practice 15. Foster Metacognition and Mindfulness

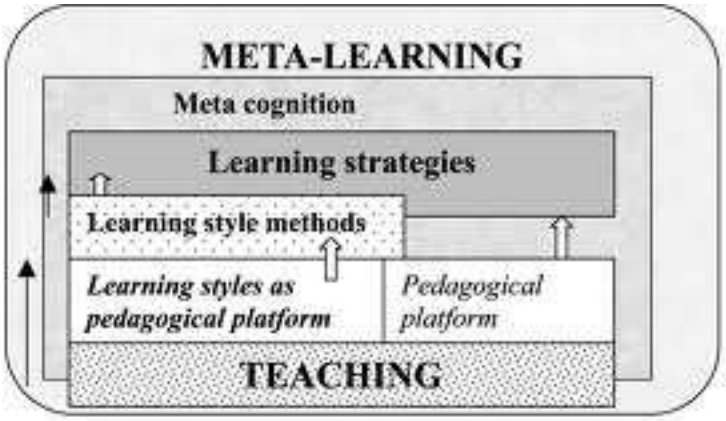
- If we as teachers hope to contribute to lifelong learning, then we must choose classroom methodologies, actions, and activities that improve thinking.



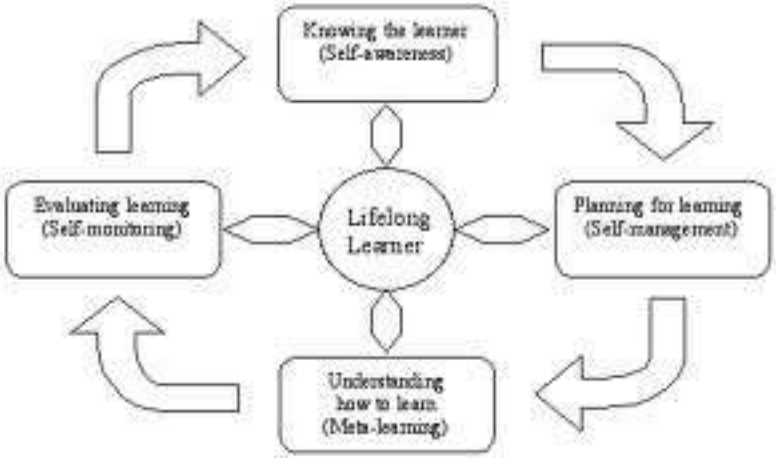
- Learning to be more conscious of our own thinking—the how and why of our ideas—is called metacognition (Borkowski, Carr, Rellinger, & Pressley, 2013; Hacker, Dunlosky, & Graesser, 2009).
- Higher order cognition is a prized skill in almost every society imaginable and often equated with metacognitive skills and critical thinking (Voss, Perkins, & Segal, 2012).
- There is evidence in neuroscience that shows how metacognitive skills are developed in the brain and how they can be stimulated with training and rehearsal (e.g., Fleming & Dolan, 2012).

- Many studies on metacognitive abilities and the brain point to **similar areas** for **decision making as for metacognition** (e.g., Fleming, Huijgen, & Dolan, 2012), which could mean that activities that rehearse decision making are beneficial in developing some aspects of higher order thinking.
- Understanding why we think about things in a particular way helps us learn better (Azevedo, 2005; Schellenberg, Negishi, & Eggen, 2011),

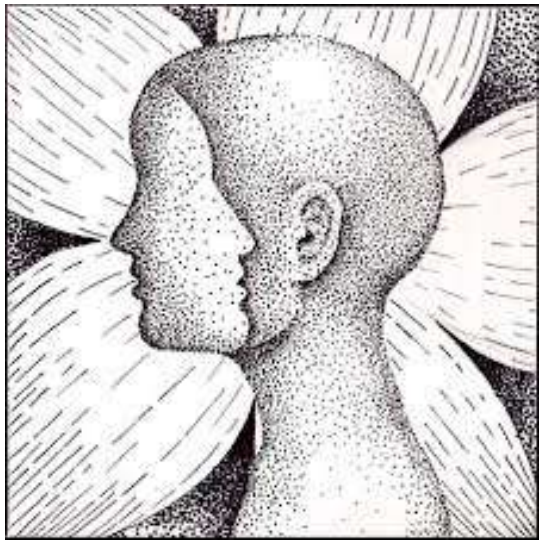
- Why is training in metacognitive skills important in overall thinking ability? Because through metacognitive practices we learn how to consciously follow self-proposed steps tailor made to our own thinking processes, creating a cycle of improved thinking across our lifespan.
- Thus, **metacognition is fundamental to lifelong learning and is highly individual**.



Note: "Pedagogical platform" could be any pedagogical platform



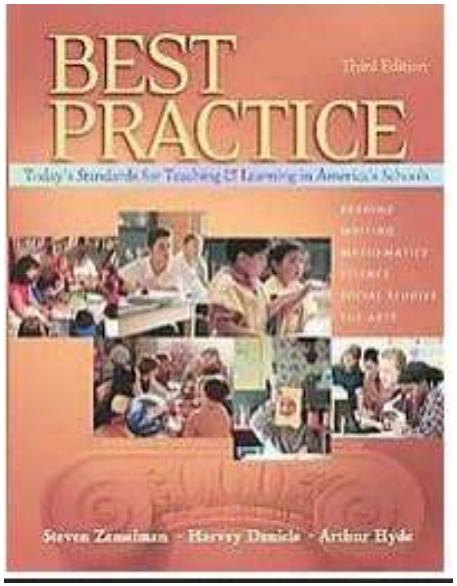
- It is important to recognize the neural elements associated with this type of learning. The brain can't help but learn—it is its *raison d'êtr*e—but it is not automated to think about how it thinks.
- According to Bollich, Johannet, and Vazire (2011), **there are "two main avenues for learning about the self: looking inward (e.g., introspection) and looking outward (e.g., feedback)"** (p. 312), but both avenues have to be modeled or taught explicitly to be successful.
- Activities that stimulate metacognition do one of two things: they either enhance knowledge about cognition, or they enhance monitoring of cognition (Flavell, 1979; Schneider, 2008, 2010).



Best Classroom Practice 16. Employ Zemelman and Colleagues' Best Practice Filter When Selecting Activities

- In *Best Practice* (2005), Zemelman, Daniels, and Hyde considered successful classroom activities and then sorted them by similar characteristics.
- They found 13 characteristics common to activities that have the most impact in classrooms.

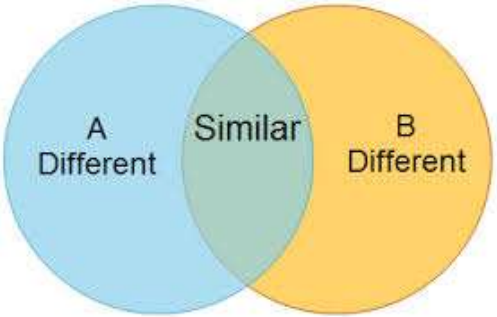
1. Student-centered
2. Experiential
3. Holistic
4. Authentic
5. Expressive
6. Reflective
7. Social
8. Collaborative
9. Democratic
10. Cognitive
11. Developmental
12. Constructivist
13. Challenging
14. (fun)

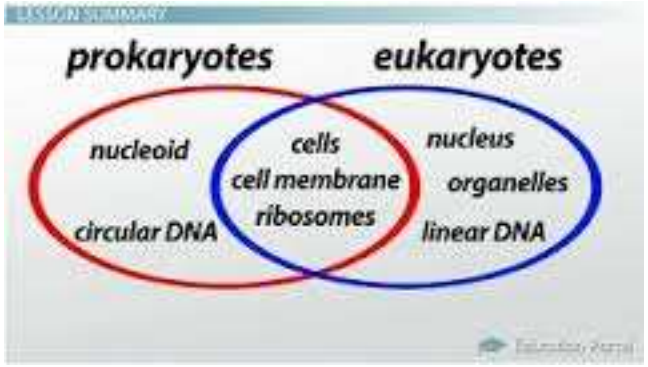


Best Classroom Practice 17. Develop Students' Ability to Identify Similarities and Differences

- Marzano and colleagues suggest that "presenting students with explicit guidance in identifying similarities and differences enhances students' understanding of and ability to use knowledge" (Marzano, Pickering, & Pollock, 2001, p. 15).
- One of the **first intellectual habits** we try to develop in our schools (and one that we prize all the way through doctoral work) is the ability to identify similarities and differences.

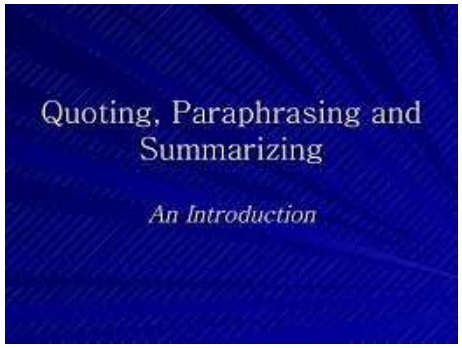
- There is evidence in MBE science (principles 9 and 10) that the brain looks for both patterns and novelty: The brain learns by comparing past experiences with similarities (patterns) and differences (novelty) in new information.
- It is most likely that the brain's "need" to look for patterns as well as identify novel aspects comes from survival mechanisms for dealing with situations in which novelty often meant danger.





Best Classroom Practice 18. Develop Students' Summarizing and Note Taking Ability

- Summarizing and note taking are skills that force students to make judgments and choices about the information they are receiving: "[S]tudents must delete some information, substitute some information, and keep some information" (Marzano, Pickering, & Pollock, 2001, p. 30).
- Different levels of thinking require different skills, and the ability to synthesize and summarize requires far more neural circuits than simple memorization. When we ask students to paraphrase what others have said, we are exercising their summary skills. Note taking, which requires higher-order thinking than simple copying, brings this to yet another level.

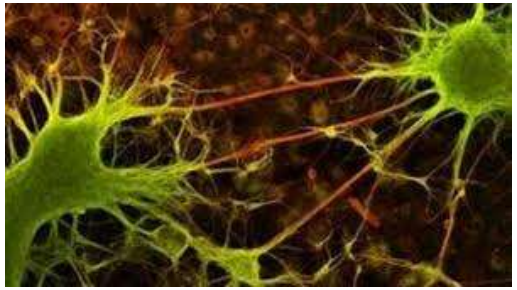


Best Classroom Practice 19. Reinforce Effort and Provide Recognition

- Though it sounds intuitive, it is good to remind ourselves that "reinforcing effort can help teach students one of the most valuable lessons they can learn—the harder you try, the more successful you are" (Marzano, Pickering, & Pollock, 2001, p. 59).
- Encouragement provides a "feel good" aspect to learning, which is the psychological interpretation of a neurological fact. "Feeling good" in the brain is due to a combination of neurotransmitters that give a sense of pleasure (see Houck, Davis, & Beiser, 1995 for a more detailed explanation of this concept).

Best Classroom Practice 20. Provide Purposeful Homework and Practice

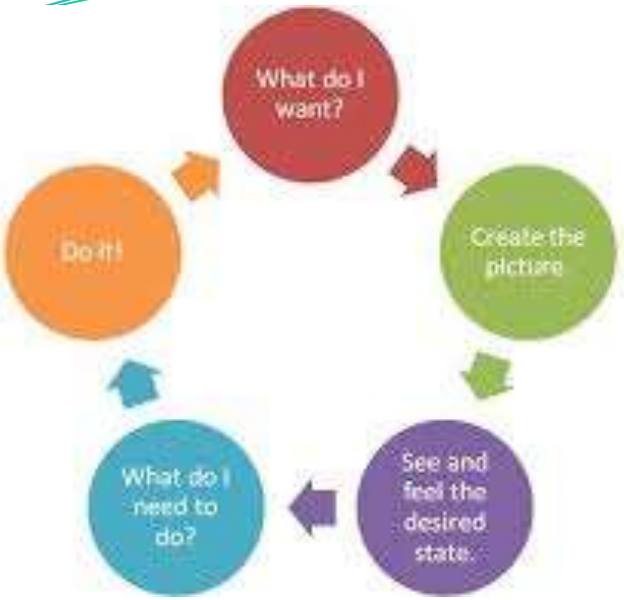
- Retrieval of information from memory systems in the brain depends on the strengths of neural networks (for initial studies in this area related to retrieval time compared with number of exposures, see Dosher, 1984, and Ratcliff, 1978). Synapses between groups and neurons in the brain reinforce the myelin sheath, which determines the speed with which information can be retrieved (Eichenbaum & Cohen, 2001).
- Homework, which provides students with the opportunity to extend their learning outside the classroom and which is commented upon (via feedback mechanisms) offers the repetition needed to strengthen neural networks, making recall and thereby learning possible.

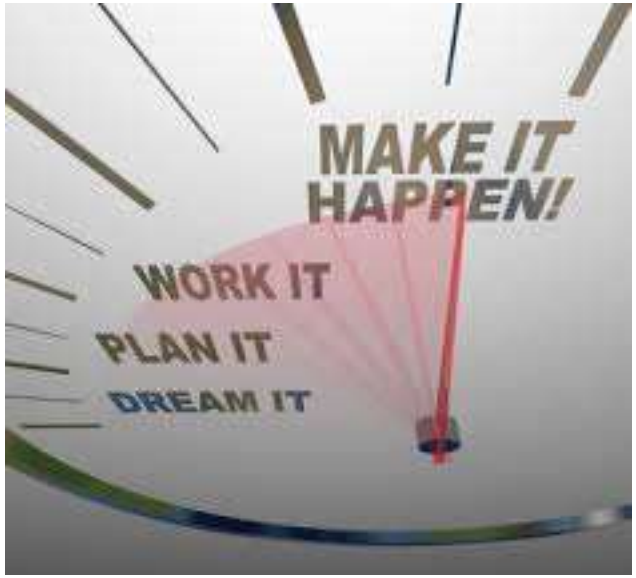


- However, only when homework is meaningful will it serve a purpose and inspire students to complete it. Homework is controversial, but the bottom line is that **“good” homework helps and “busywork” disguised as homework does not work** (Hattie, 2009; Marzano & Pickering, 2007).

Best Classroom Practice 21. Prepare Students to Set Personal Objectives and Give Themselves Feedback

- The development of these skills in classroom contexts is the first step in habituating students to this action, although the home influence is also important. Initially it's the teacher's responsibility to set clear goals and provide feedback as the student progresses toward them, but the real role of the teacher is to eventually ensure that the student learns to execute these skills on her own (Zimmerman & Schunk, 2013).

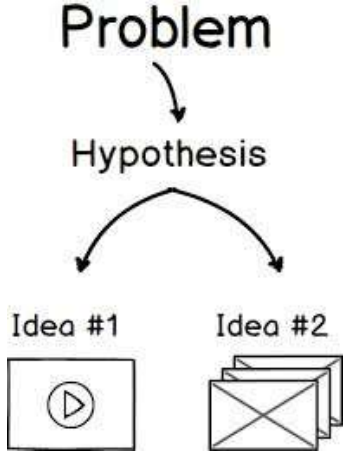




- Part of being an autonomous learner is knowing how to determine your own targets, set a path toward achieving those goals, and find ways to self-assess.
- Autonomous learners don't wait for others to judge their actions or the success of their endeavors.
- The ability to give yourself a mental pep-talk means you understand what it means to set goals and generate feedback to reach your own objectives (Mynard & Navarro, 2010).

Best Classroom Practice 22. Teach Students to Generate and Test Hypotheses

- **Students should learn to assess information and come up with hypotheses about how the world works.** Students should be pushed to make predictions and generate hypotheses that they can explain to others (Marzano, Pickering, & Pollock, 2001). The daily fare of learners is to test thesis proposals and modify hypothesis, improve upon theories, and try again. The only way to learn is to recognize mistakes and methodologically seek new possible answers.



Best Classroom Practice 23. Use Cues and Triggers

- Cues are great ways to trigger past knowledge, while questions instigate reflection. Teachers who use cues, questions, or academic hints in their daily practice are giving students a pattern for the way they should approach self-questioning in the future.
- Students need to heed the inscription on the temple of the Oracle of Delphi and “know thyself” to self-start their thinking.
- Part of autonomous learning is discovering what types of things work best for you that might not work for someone else. One of the reason hints are even more successful than direct questioning is that the learner is able to believe she found the answer herself (Bowden, 1997).

Summary of Best Classroom Practices 1–22

<table>
<tr><td rowspan="2">Planning</td><td colspan="3" rowspan="2">Design activities that stimulate:

Memory and attention</td><td colspan="4">Design activities that take advantage of:

Spaced versus massed practice and retrieval</td><td>Design activities that are:

Transdisciplinary and in context</td></tr>
<tr><td>Repetition</td><td>Variation</td><td>Significance</td><td>Depth</td><td>Authenticity</td></tr>
<tr><td rowspan="2">Evaluation</td><td colspan="3">Emphasize:

Formative evaluation practices</td><td colspan="4">Always provide:

Shared, explicit learning objectives</td><td rowspan="2">Embrace the perception that:

Teaching is dynamic and intelligence is fluid</td></tr>
<tr><td>Product</td><td>Process</td><td>Progress</td><td>Teacher clarity</td><td>Commu-nication immediacy</td><td>Feedback</td><td>Student-teacher relationship</td></tr>
<tr><td>Activities</td><td colspan="3">Apply methods, techniques, strategies, actions, and activities that enhance:

Metacognitive skills</td><td colspan="4">Apply methods, techniques, strategies, actions, and activities that have characteristics similar to:

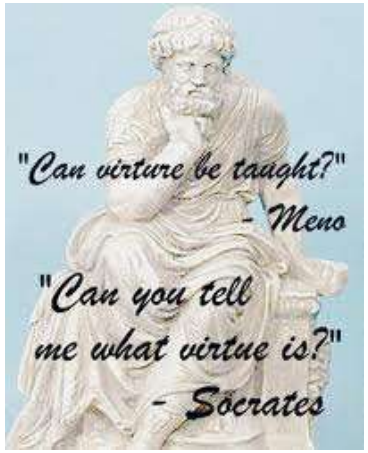
Zemelman et al.'s Best Practice guidelines</td><td>Apply methods, techniques, strategies, actions, and activities that incorporate:

Marzano et al.'s instruc-tional strategies</td></tr>
</table>

Ancient Methods in a Modern World

Best Classroom Practice 24. Use the Socratic Method

- The oldest known teaching
- method still used today is the Socratic method (Reich, 2003).
- Socratic dialogue is meant to help students discover their own “ignorance” or gaps in knowing through constant questioning.
- “Never tell what you can ask.”

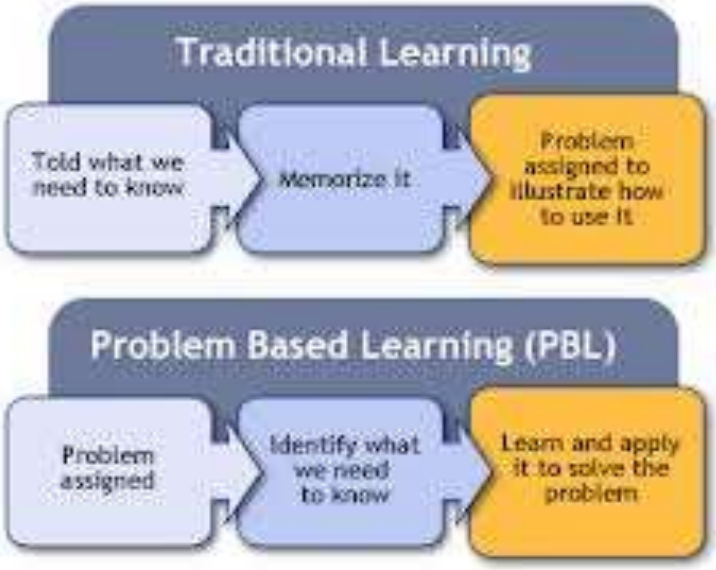


Best Classroom Practice 25. Cultivate the Art of Questioning

- Humans are naturally curious, which explains how the species has survived. Innovation and self-improvement are actually our trademark characteristics (Loflin, 1978).

- Questions that begin with *who*, *what*, *when*, and *where* are finite and closed, generally leading to rote answers that don't require deep thinking skills (as in "Where [or when] was the Gettysburg
- Address delivered?"), but *how* and *why* questions give pause for reflection because they're open to interpretation and require argumentation ("How was the Gettysburg Address delivered?"; "Why was the Gettysburg Address delivered?").

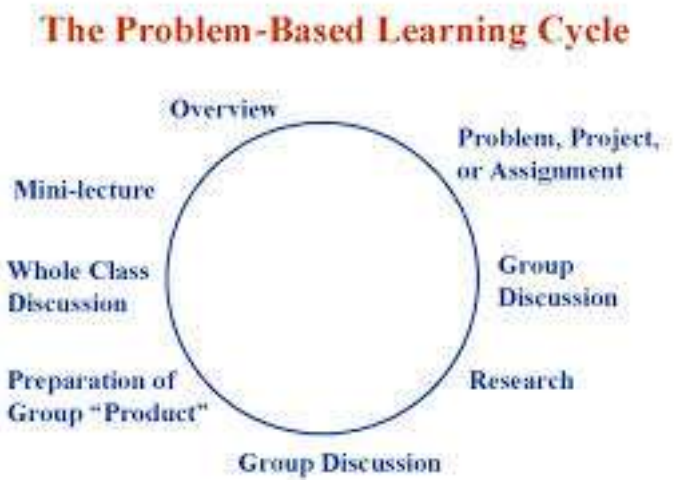
Best Classroom Practice 26. Incorporate Problem-Based Learning



Small group learning

- Problem-based learning, alongside project-based learning and learning-through-design models, is one of the main inquiry-based methods of teaching (Dumont, Istance, & Benavides, 2010). Problem-based learning (PBL) focuses on real situations (problems) that have yet to be resolved (Choi & Lee, 2009).

- Problem-based learning works because learning takes place in an authentic context that students can relate to, which easily leads to transfer.
- *Transfer* is in part, the ability to view and use information in a variety of settings.
- “To know is not enough” (*Non Satis Scire*, AERA conference theme, 2012); application takes knowledge beyond the classroom and places it in real life, turning it into “usable knowledge.”
- When students are faced with a real-life problem as found in PBL structures instead of a problem set in a textbook, they are more motivated to seek the correct answers.
- **PBL research happens individually, but solutions are found at the group level.**
- **1+1=3**



Best Classroom Practice 27. Incorporate Cooperative Learning

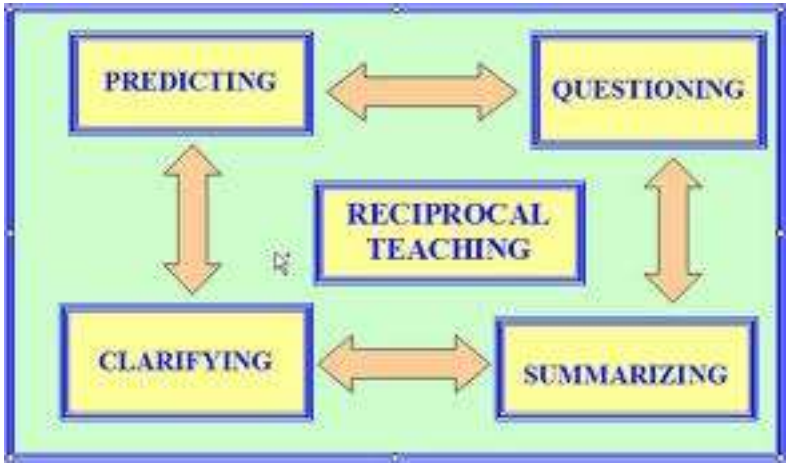
- Cooperative learning occurs when two or more learners work toward a collaborative solution to a challenging situation. Marzano (2009) notes that organizing students into cooperative groups yields a positive effect on overall learning.
- **Cooperative learning is based on the human need for social exchange, goal setting, and relationship acquisition**.

- **Cooperative learning relies heavily on both the ability to express ideas and the ability to listen to others**.
- "The pedagogy of listening" from the Reggio Emilio school.

- **A group's capacity for working together is far less dependent on the academic prowess of its members than it is on participants' "ability to listen and respond to one another's ideas"** (Barron, 2003, as cited in Ritchhart et al., 2011, p. 37).
- Cooperative learning also offers an avenue for age-appropriate exchanges of information as a means of explaining terms in alternative forms or vocabulary that might not be so clear when a teacher uses textbook vocabulary. Kid-to-kid conversations often lead to a clarity that eludes teacher-to-kid or text to student interaction.

Best Classroom Practice 28. Incorporate Reciprocal Teaching

- Peer teaching, or reciprocal teaching, occurs when two or more people teach one another (Rosenshine & Meister, 1994). Reciprocal teaching can be done between a teacher and a student, between two students, or even between two teachers, usually for the mutually beneficial outcome of learning on both sides, but without the goal of a shared outcome (even though the two learners can have two different objectives). The idea is that each takes turns leading and following.



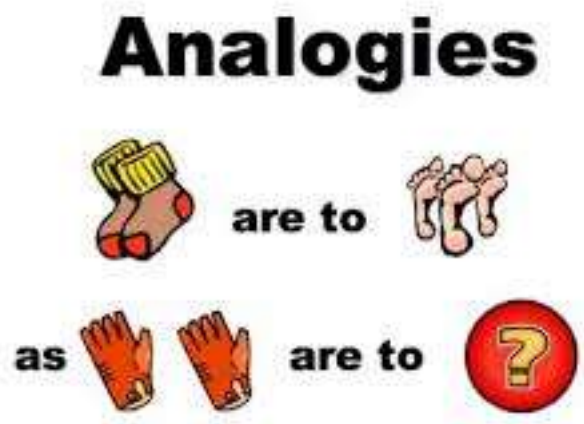
- In reciprocal teaching, four specific steps are followed to enhance comprehension: (a) questioning, (b) clarifying, (c) summarizing, and (d) predicting. These steps are conducted interchangeably by student and teacher (Pilonieta & Medina, 2009).

Best Classroom Practice 29. Incorporate Case Studies

- Case studies are written summaries or syntheses of real-life situations. They differ from problem-based learning in that they examine problems that have already reached some kind of a conclusion.
- Case studies require each participant to take on the viewpoint of a specific actor and think of key points of the case from that perspective only.

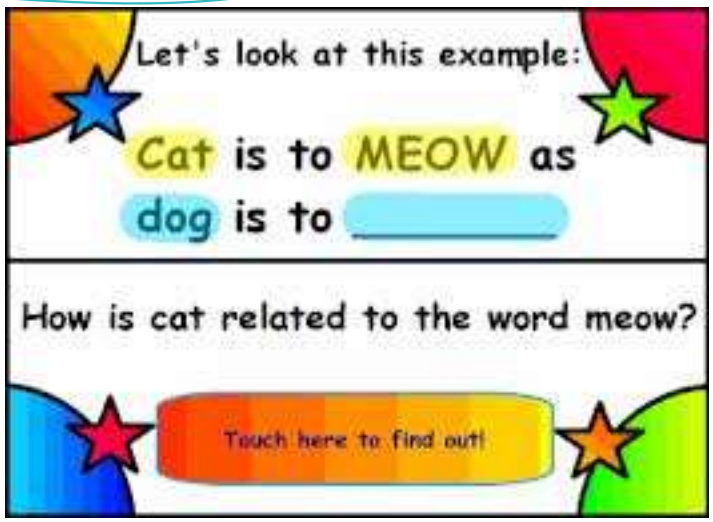
Methods for Teaching All Subjects and All Ages

Best Classroom Practice 30. Harness the Power of Analogies

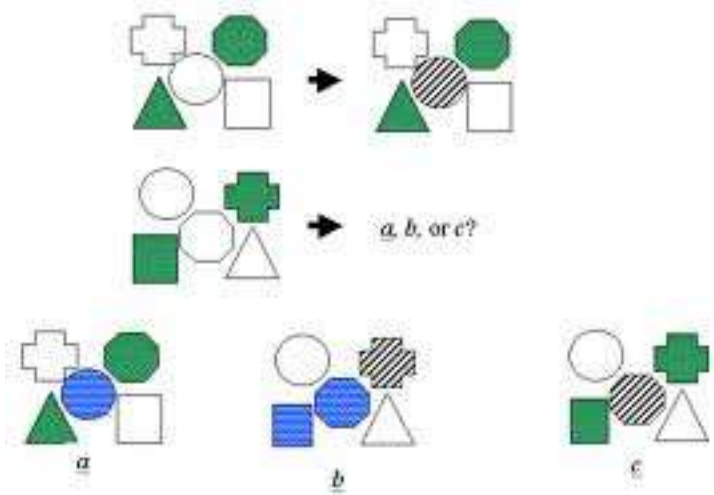


Types of Analogies	
Part to whole	battery : flashlight :: hard drive : computer
Cause and effect	fatigue : yawning :: itching : scratching
Person to situation	mother : home :: teacher : school
Synonym	obese : fat :: slender : thin
Antonym	poverty : wealth :: sickness : health
Geography	Chicago : Illinois :: Denver : Colorado
Measurement	pound : kilogram :: quart : liter
Time	March : spring :: December : winter

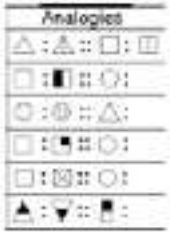
- Kauchak and Eggan (1998) suggest that **the introduction of new content should always be done within a familiar frame of reference.**
- When direct links to past knowledge are not available, **the use of analogies is key**: “The closer the fit of the analogy, the more learning is facilitated” (Kauchak & Eggan, 1998, pp. 295–296).



- Analogies work because the brain is consistently comparing what it already knows with new experiences to find patterns and novelty, which places concepts into known mental schemata (McDaniel & Donnelly, 1996; Richland, Zur, & Holyoak, 2007).
- Being able to piece together knowledge from past experiences is a fundamental aspect of all new learning and vitally important in developing thinking skills.
- Using teamwork to develop analogies and other metacognitive facilitators enhances the probability of learning (Hooper, Sales, & Rysavy, 1994; T., Johnson, Archibald, & Tenenbaum, 2010).



Analogy Examples

Measurement Kilogram: Pound :: Liter: ?	Parts to wholes Hard drive: Computer :: Engine: ?	Cause and effect Fatigue: Yawning :: Fright: ?
Shape and Proportion 	Profession and tools: Photographer: Camera :: Mason: ?	Person to situation Teacher: School :: Pilot: ?
Forms and Orientation 	Synonyms Slender: Think :: Obese: ?	Geography Washington: DC :: San Francisco: ?
Agent and Action Brain: Thinking :: ? : Typing	Proportion and Form 	Relationships Geologist: Rocks :: Astronomer: ?
Category Orange: Fruit :: Pecan: ?	Part to whole Chapter: Book :: Scenes: ?	Type and sub-type Basil: Herb :: Oak: ?

Best Classroom Practice 31. Implement the 5Es: Engage, Explore, Explain, Elaborate, Evaluate

Progression of the 5Es Model

SCIS Model (Hebart & Dewey, 1910)	BSCS 5Es Instructional Model (1960s)	7Es (Eisenkraft, 2012)
		Elicit prior knowledge (new phase)
	Engagement (new phase)	Engagement
Exploration	Exploration (adapted from SCIS)	Exploration
Invention (term production)	Explanation (adapted from SCIS)	Explanation
Discovery (concept application)	Elaboration (adapted from SCIS)	Elaboration
	Evaluation (new phase)	Evaluation
		Extend (practice transference) (new phase)

5E Instructional Model

- Why do the 5Es work? **They work because they offer the right balance between discovery learning and explicit instruction.** Yes, it's good for students to be able to find things out on their own, but we also know that a high percentage of the information exchanged between students is incorrect (Hattie 2009); students can mislead each other because they haven't really mastered the concepts at hand.

  The 5Es provide space for explicit instruction (in the elaboration phase), in which the teacher can confirm that everyone is on the same page in regard to vocabulary, definitions, and core concepts. Unlike other explicit teaching models, however, the 5Es are dominated by student-centered, not teacher-centered, activity.

What *Could* Work in the Classroom and Why

A Teacher's List of 12 Habits

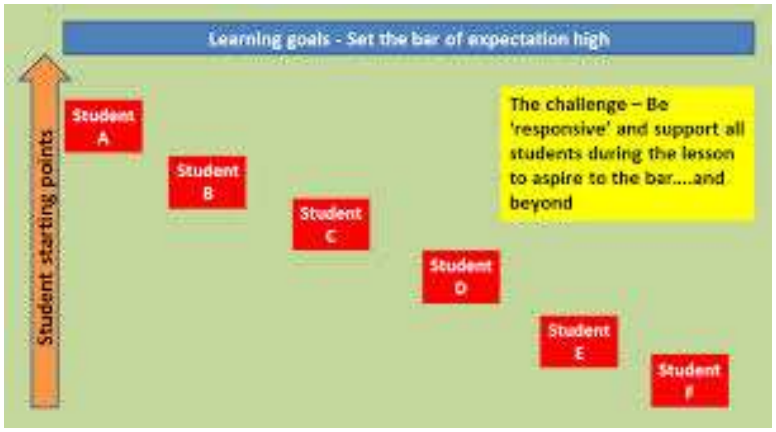
Best Classroom Practice 32. Improve Student Self-Efficacy

- **If a student thinks she can learn, she will**. There is now no doubt that a student's own self efficacy as a learner has an influence on how well how she actually does in school.
- According to Hattie's research (2009), a student's self-reported grades are the greatest indicator of improved learning. In many ways, this is a self-fulfilling prophecy: "If I think I can learn, I will; if I believe I am incapable of learning, I will fail."
- **Why, then, don't all teachers make it their first act to instill a sense of self-confidence in their students?**

Best Classroom Practice 33: Maintain High Expectations

- **Learners respond to expectations**.
- Students performed to the level of their teacher's expectations, high or low (Good, 1987; Good & Brophy, 1997; Rubie-Davies, 2010).
- **This tells us, both as parents and as teachers, that while we should be realistic, we should also ask the kids in our lives to stretch just a bit higher than they think they can reach**.

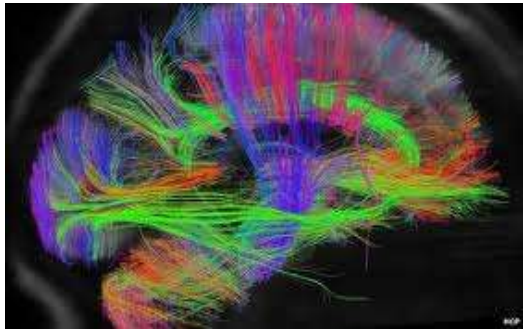
- Teachers often convey expectations without clearly understanding their own impact on student learning.
- Many teachers don't even realize how they are communicating low expectations to their students.
- For instance, a noteworthy finding of Hattie's work is that failing a grade is a strong indicator for future failure, primarily because the student loses faith in her own ability to learn because her teachers— those "in the know"—have deemed her unable to learn.
- On the other hand, the joy of learning is a great motivator, and people who love learning have often had at least one teacher in their lives who has given them confidence in their ability to learn and pushed them to achieve more than they believed they were capable of.



- Independent of the level of expected achievement (low, middle, or high) of a group, teachers should aim high (Rist, 1970). The higher the expectations, the higher the achievement (Good, 1987; Good & Brophy, 1997).

Best Classroom Practice 34. See Learning as Fluid

- It is actually impossible for the brain not to learn.
- Intelligence is fluid, not fixed, though this has been debated for fifty years (Cattell, 1963; Kane & Engel, 2002; Sternberg, 1981).
- Teachers who believe that their students are locked into a level of intelligence that is fixed are less effective than teachers how believe that intelligence in fluid and ever-changing (Geake, 2011).
- The human potential to learn exists throughout the lifespan (barring neurodegenerative diseases or accidents); a normal human can and does learn because intelligence is fluid.
- **Expert teachers do not label their students**.



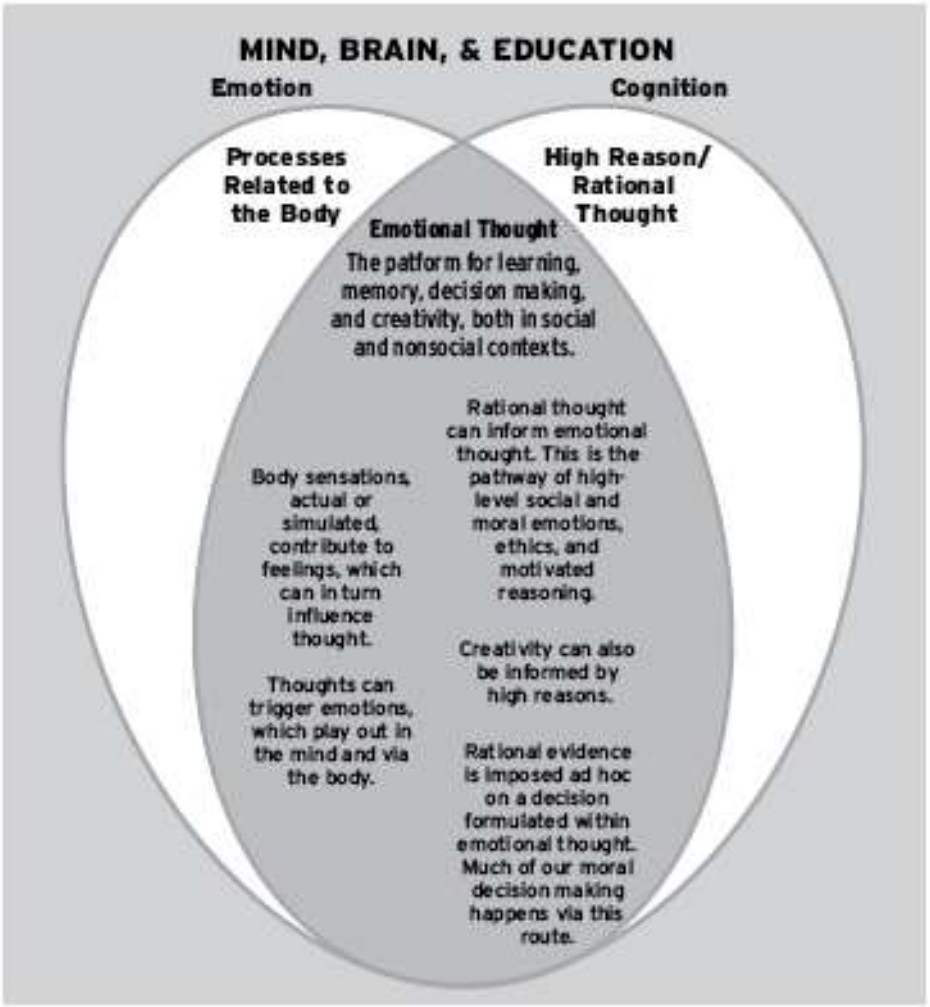
Best Classroom Practice 35: Appreciate the Role of Affect in Learning

- There is strong evidence in neuroscientific research and in psychology that affect influences learning (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Kim & Pekrun, 2014; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011).
- Another key belief that teachers should embrace is that emotions are critical to learning. The exact relation? **There is no decision without emotion, and there is no learning without decision-making; therefore, there is no learning without emotion**.

- Learning new information is influenced more by emotional states than retrieval of the same information (Storbeck & Clore, 2011).
- Teachers who cause students to experience high anxiety lower the probability of learning as compared with students who feel calm or happy or consider the learning experience pleasurable (D'Mello, 2012).

- Example: learning is enhanced by challenge and inhibited by threat—highlights the importance of emotions. While this statement seem fairly obvious, it is clear that the level of challenge or threat felt by one person relative to another is difficult to measure, making this a hard concept to nail down.

The Intersection Between Emotion and Cognition

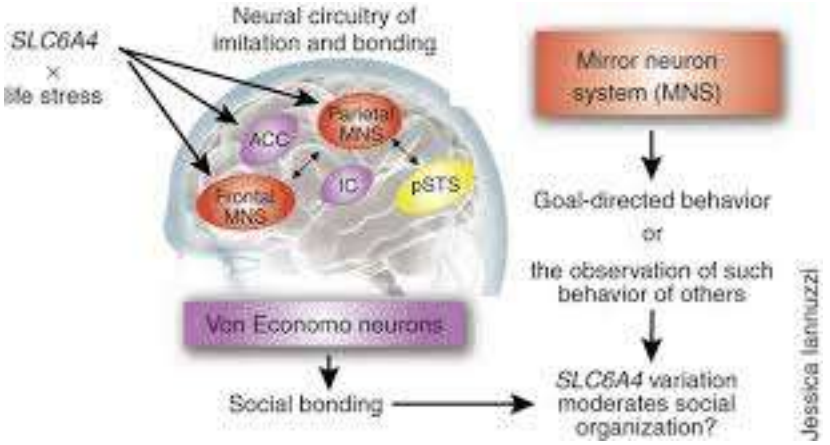


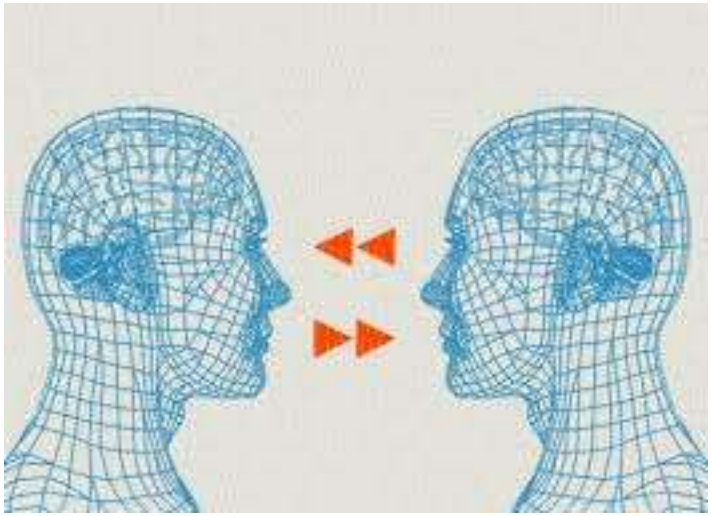
Source: Reprinted from Mind, Brain, and Education, *Mary Helen Immordino-Yang and Antonio Damasio, "We Feel, Therefore We Learn: The Relevance of Affective and Social Neuroscience to Education," pp. 3-10, March 12, 2007, with permission from John Wiley & Sons. © 2007 International Mind, Brain, and Education Society and Blackwell Publishing, Inc.*

Best Classroom Practice 36. Take the Lead in Social Contagion

- Social cognition (understanding others) plays a large part in how and what we choose to learn (Campbell-Meiklejohn, Bach, Roepstorff, Dolan, & Frith, 2010), as well as how information is processed in our brains (Immordino-Yang, 2011; Nummenmaa, Glerean, & Sams, 2012).
- Teachers communicate to their students verbally and nonverbally, but they are often conscious only of the message sent and not the message received.

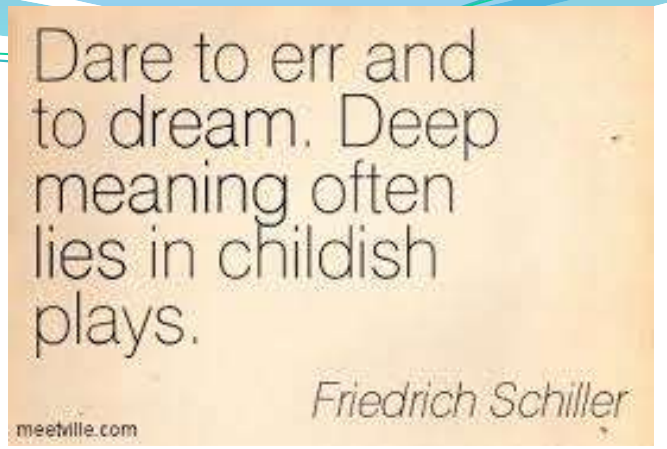
- The complex mirror neuron system in the brain appears to be triggered when the brain perceives, then acts on, an understanding of “the Other” (Pineda, 2008).





Best Classroom Practice 37. Award Perseverance and Celebrate Error

- Some people are open to the world. They welcome new experiences and enjoy the challenges of life. But there is a special subgroup of this crowd who welcome error because it helps them learn. To them, “Every problem is an opportunity.” They are not fearful of constructive criticism, but embrace it.
- We learn about the world through our senses, which means that our learning is dependent on new experiences. Thus, **people who have a great degree of open-ness to experiences learn faster than those who don’t**: If I can handle facing the error, I can learn faster.

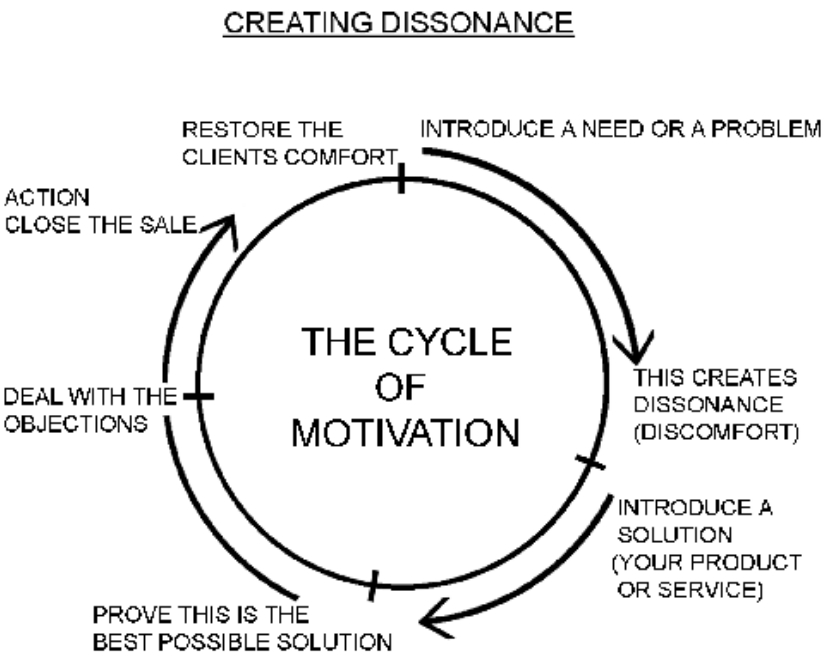


- Children who are reared in environments where experimentation is welcomed and error is greeted with praise (for the child's intentions, if not her success) are kids who learn fast.
- They make a lot of mistakes, but they learn from them. Children who are brought up in families or schools that praise only excellent work or obvious successes and fail to recognize good tries do not dare to err and thus do not learn as much as fast. "Dare to err" should be a mantra in education.

Best Classroom Practice 38. Motivate

- Motivation hinges on a few of the key concepts outlined in other Best Classroom Practices, as shown in Hattie's studies. Constructivist activities help sustain focus on learning tasks.
- No one likes to do things that are too easy or too hard; we seek learning experiences that are just slightly beyond our reach. Classroom interventions that are active, social, collaborative, and authentic lead to better memory and more sustained attention.
- Motivation is a tenet of MBE because it influences all learners, but no one in exactly the same way.

- Anderman, Andrzejewski, and Allen (2011) tried to determine how teachers can increase student motivation and learning in their classrooms and "suggested a model that consists of three core themes: **supporting understanding, building and maintaining rapport, and managing the classroom**" (p. 969).
- That is, part of a student's motivation comes from simple best practice planning, teaching, and managing. Earlier studies note that classes that provide regular, formative feedback ar espouse mastery learning goals rather than simply "teaching to the test" produce more highly motivated students (Ames, 1992; Ames & Archer, 1988).

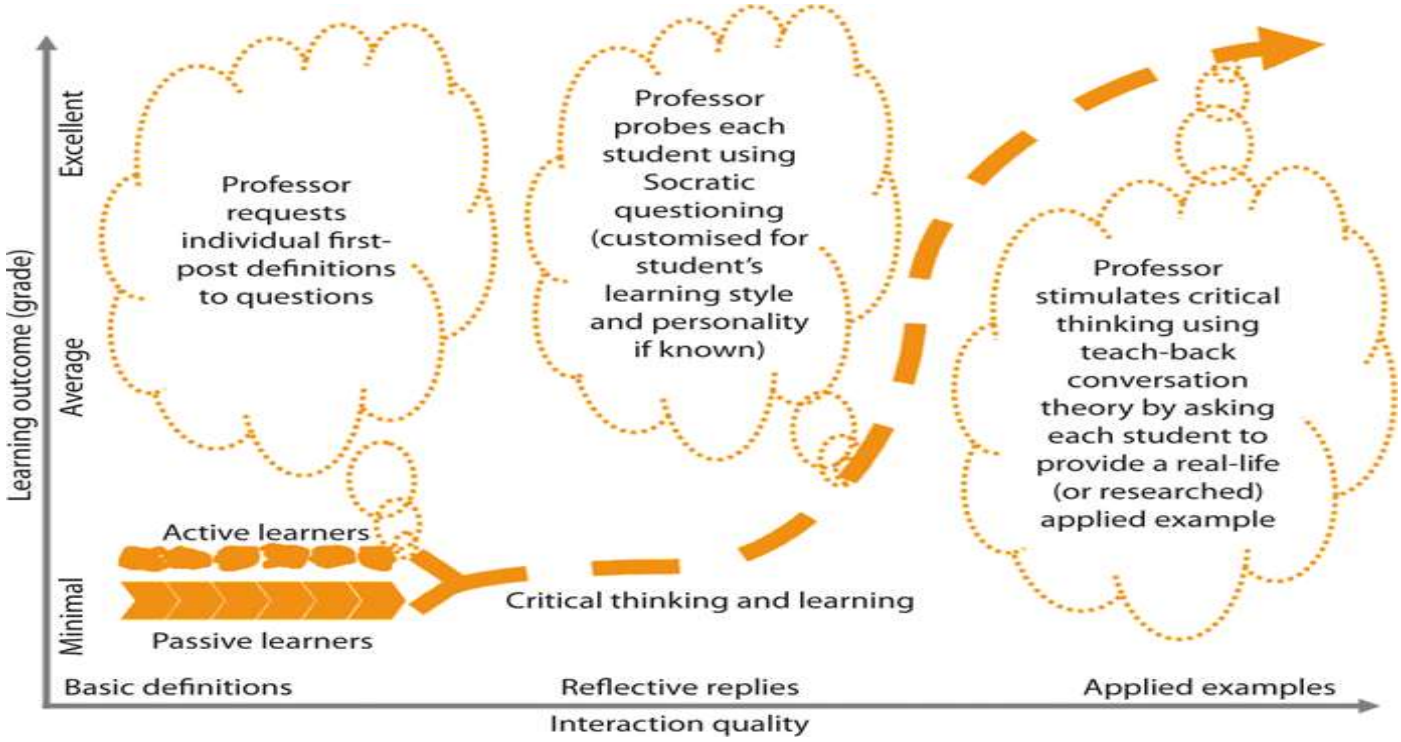


Best Classroom Practice 39. Never Work Harder Than Your Students

- Robyn Jackson considers several core principles of teaching in her book *Never Work Harder Than Your Students* (2009).
- **Human beings usually choose to do the minimum to get by** (Kingsley, 1949). This is efficient and logical: Extra effort can be detrimental to one's existence, and energy should be saved for when we really need it.
- Just as neuroconnections are lost when they go unused—see the Hebbian synapse (Hebb, 1949), "use it or lose it"—due to the brain's efficiency, some students save up their energy for use on "more important" things.

- In the classroom setting, many students don’t exert more effort because their energy is better spent doing other things. It takes energy to learn, and students parcel it out sparsely in order to survive. An observer might say that these students aren’t motivated, but they are actually conserving their energy and lying in wait for something that deserves their attention.
- Thus, instead of being discouraged, teachers should take control of the situation and spiral up the energy. For instance, this might mean refraining from giving students the answers to questions and instead formulate questions that force them to find their own answers.

- Some students become frustrated when the teacher withholds information in this way.
- What they fail to recognize in that learning is born of this frustration or cognitive dissonance.
- This doesn't mean that teachers should exert minimal force, but rather they should create learning moments that push students and their efforts upwards.



Best Classroom Practice
40. Be Passionate!

- Imagine a beginning course in education: “Teacher Passion 101.” Could you pass this class? If you aren’t passionate about what you’re doing, you should really look for another career; the **teaching profession can’t afford apathy or fear.** However, passion is not a tangible or easily structured concept, which is why it has evaded the core curricula in teacher colleges.

- The passion with which a teacher approaches the profession is more important than all other factors combined; passionate people are the reason teaching works (Hattie, 2009).
- This is not to say that someone with passion and no skills can a run a classroom, but rather that someone with all of the content knowledge, techniques, methodologies, and activities in the world won't be successful unless he is also passionate.
- **Without passion, there is no motivation, and without motivation (positive or negative, intrinsic or extrinsic), there is no learning.**
- **People who love what they are doing are contagious and inspirational**.

Best Classroom Practice 41. Design Engaging Classrooms

- **An engaged classroom is like a suspense film, keeping students hooked throughout the entire class period.**
- **Your brain pays attention to different things at different times for different reasons.** Your brain is drawn to elements that help sustain your focus. When the situation is not engaging, sustained focus is dropped.

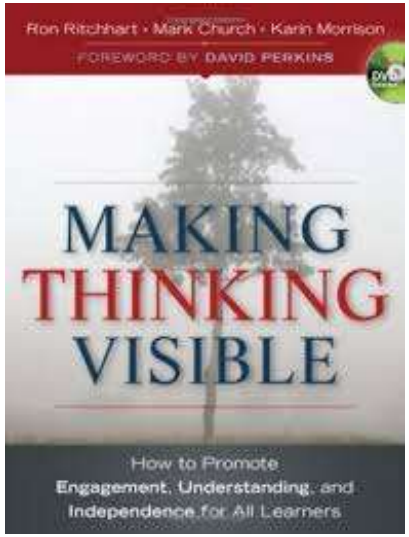
- The difference between what's happening in class and what's important in real life is sometimes a formula for "boredom."
- Teachers need to be more aware of ways that their school subjects can be integrated with (not replace) the students' natural interests.

Best Classroom Practice 42. Manage

- Great teachers know that, even if you have oodles of content knowledge and a firm handle on teaching methodologies, you won't succeed if you have poor class management skills. Here we take a broad view and consider a good classroom manager to be someone who expertly manages the socioemotional ambience of the group and encourages student experimentation and even error. For instance, **effective classroom management often entails stifling negative disturbances.**
- **Good classroom management doesn't result in silence; it results in learning.**

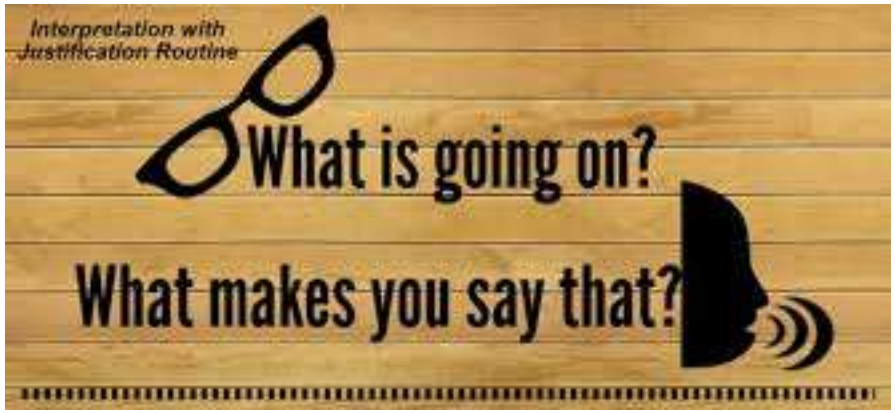
Best Classroom Practice 43. Use Thinking Routines

- Most teachers want to stimulate better thinking in their students and see it as their job to inculcate more sophisticated processes than simple, direct instruction.
- There are a number of ways to do this, and one of them is by habituating students to short classroom patterns that hone in on ways of thinking to improve understanding. Ritchhart, Church and Morrison (2011) propose 21 “thinking routines” that support understanding.



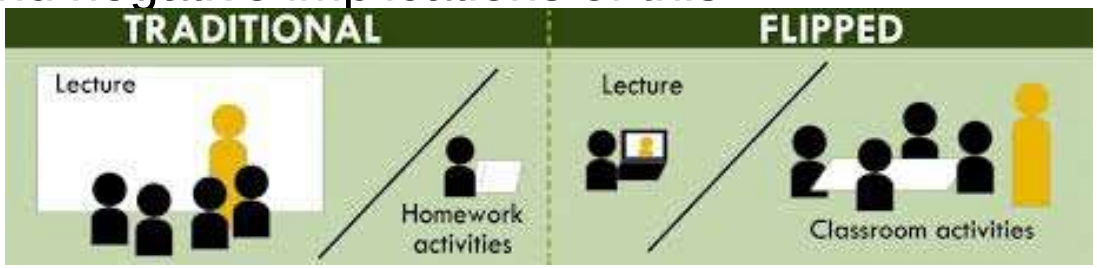
- ***Interpretation and Articulation***
  - Example: Zoom In
- ***Hypothesis Development***
- ***Decision-Making***
  - Compass Points
- ***Synthesizing and Summarizing***
  - Headlines

- ***Understanding One's Own Perceptions***
- ***Metacognition***
  - "I Used to Think . . . Now I Think . . . "
- ***Empathy***
- ***Limiting One's Own Presumptions***

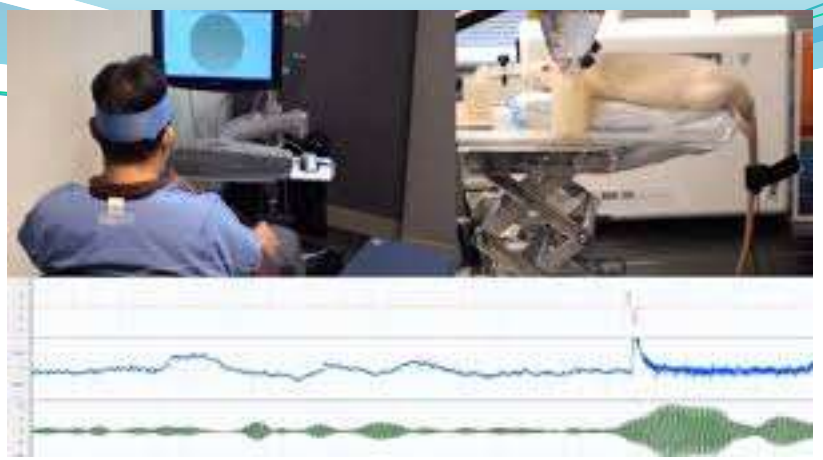


Best Classroom Practice 44: Technology and Flipping the Classroom

- There is also some evidence that technology changes the brain (Howard-Jones, Ott, van Leeuwen, & de Smedt, 2011), as do all experiences, but little direct evidence of how this occurs in a classroom (for some promising areas of research, see Laffey, Schmidt, & Galyen, 2013; Long, 2013; Low, Jin, & Sweller, 2011; Schrader & Bastiaens, 2012; Torrente, Del Blanco, Marchiori, Moreno-Ger, & Fernández-Manjón, 2010).
- This means that brains today have possibly been rewired in a distinct way from brains of previous generations due to the new and ever-changing array of technologies found in society but we are unsure of all the positive and negative implications of this.

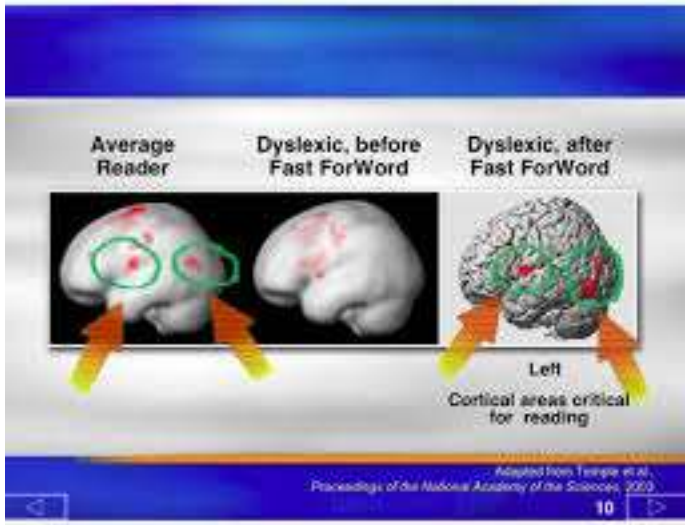


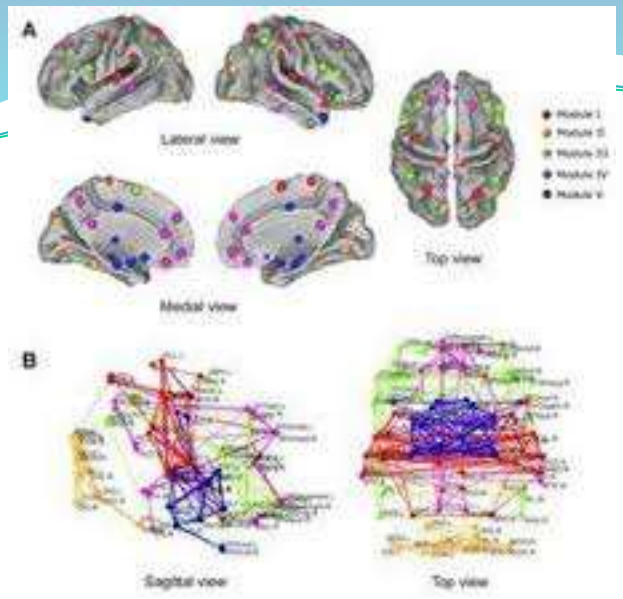
- The problem with judging whether or not “technology” is good or bad is similar to trying to judge whether or not “books” or “television” are bad; it depends on the content.
- While it is logical to presume that rapid texting, video games, and filming techniques with brisk movement that integrate ever-rapid changes of scenes demand that attention networks reprioritize routes for processing, the precise way this happens is still unknown.
- The information that does exist indicates that the brain changes with experience, and that kids these days spend a good deal of time on computers and gaming, at least some of which can be leveraged for better teaching (for examples see Annetta & Minogue, 2011; Cheng & Annetta, 2012; Gratch & Kelly, 2009).

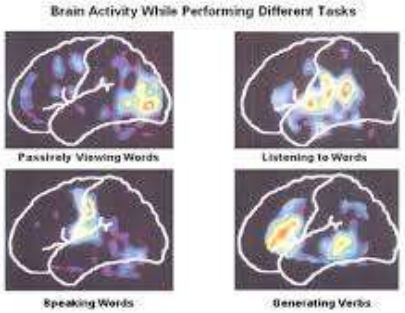


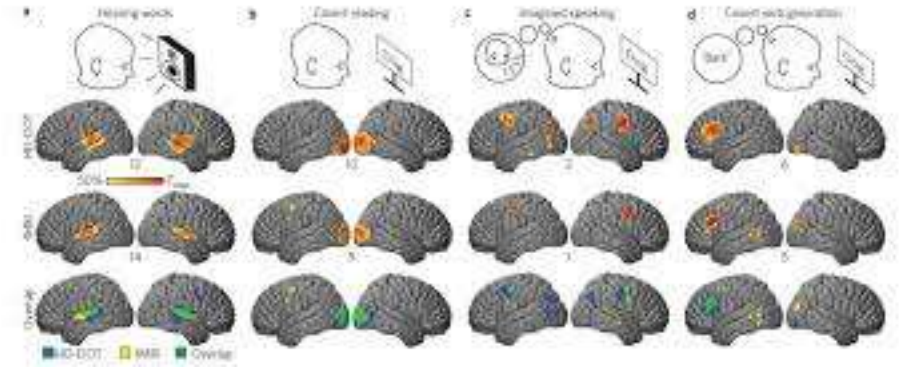
- Brains bathed in technology are wired distinctly from those with no contact with technology.
- Some studies show that the brain's need for novelty is better satisfied with these quick changes, more so than that achieved by a static teacher who stands at the front of the room and lectures in a monotone voice (Barceló, Periañez & Knight, 2002; Huang, Belliveau, Tengshe, & Ahveninen, 2012).

- Specific learning interventions that unify efforts from neuroscience, psychology, and education include Fast ForWord (Arendal & Mann, 2000), the Number Race (Wilson, Revkin, Cohen, Cohen, & Dehaene, 2006), and RAVE-O (SEDL, 2009; Wolf, Miller, & Donnelly, 2000), which focus on basic reading and math interventions.







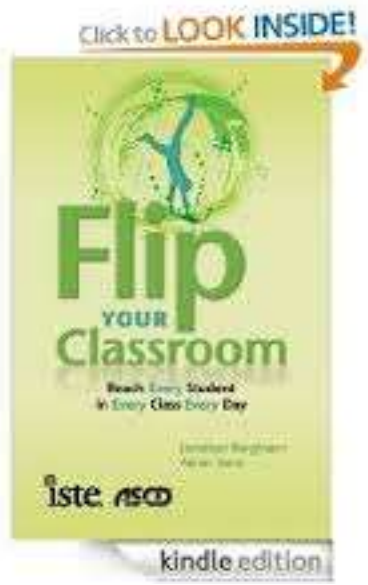


- It is clear that humans process language differently in the brain depending on whether or not is it spoken, read on a screen or in a book, for example: “By far the most common experimental finding is that silent reading from screen is significantly slower than reading from paper” (Dillion, 1992, p. 1300).
- Reading is also distinct depending on whether it is conducted out loud or silently and by looking at someone when hearing speech, or only hearing their voice (Hall, Fussell, & Summerfield , 2005), but it has not been determined if videos have the same effects on the brain as live speech.

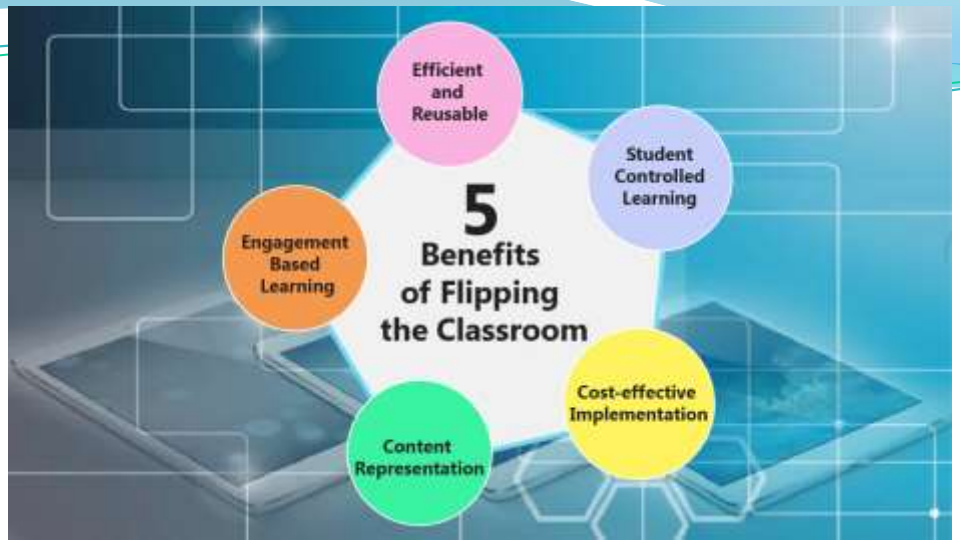
- The way advances in technology have changed communication has made many wonder whether the quality of human interactions is declining, but the general outlook appears to be quite positive. At the American Educational Research Association meeting in 2012, there was a lot of talk about “expanding literacies” (see Daley, 2003; Simon, 2007) based on early childhood exposure to the media.

- A word of caution is in order: The brain adapts to what it does most. Thus, if an individual plays high-speed video games that continually demand quick but simple responses, it will not be as adept at managing other behaviors that require longer periods of concentration or more precise responses.
- I have maintained a rule in my home since my children were small. For every hour on any screen (TV, computer, video game), they give back an hour of reading. Since reading requires sustained attention, the goal is to balance out the demands of quick changes in focus required by screen action.

- One example of technology use that takes advantage of what we know about the brain and learning is the flipped classroom.
- To use this methodology, a teacher must ask himself one question: What is the best use of my face-to-face time with my students? And then, with that in mind, he “flips” most everything else.
- What would normally happen in a classroom (teaching the subject) is done at home by watching videos and reflecting on content through exercises, and what usually takes place at home (reviewing what you don’t know) is done in the classroom along with other inquiry-based learning activities with the teacher.



- The International Society for Technology and Education heartily backs the flipped classroom concept and sees it as one way of equalizing the playing field (Bergmann & Sams, 2012).



- The flipped classroom works because it takes into account the fact that each brain is unique and uniquely organized (MBE principle 1).
- The structure of the flipped classroom permits teachers to meet each student's needs in an individual way.
- The flipped classroom also addresses the fact that not all brains are equally good at all things, and therefore different students will need more rehearsal of different concepts; flipping allows students to
- review as many times as necessary on an individual basis.
- Similarly, some students will want to hear the information while others will want to reread and underline ideas; flipping provides these options.
- Brains seek novelty (MBE principle 10), and offering information in a variety of formats aids memory systems.

- Feedback is vital to learning, and the flipped classroom creates more time and space for student-to-teacher interactions.
- The format of the flipped classroom also means that there is a great deal more practice of concepts as opposed to simple theoretical exchanges.
- The flipped classroom reduces anxiety because questioning can occur in nonthreatening ways (via email or one-on-one) as opposed to in large classroom settings in front of many peers.
- The flipped classroom also permits better classroom design and management.
- On the whole, the flipped classroom takes advantage of technology to improve learning experiences and is compatible with many MBE principles.

School Design Choices That Impact Student Learning

Best Classroom Practice 45. Pay Attention to Ages and Stages

- Modern education is conscious of the “ages versus stages” divide: School systems tend to divide students by age, despite the fact that many are at different stages of development (Chaudhari & Kadam, 2012; Heo & Squires, 2012).
- Not all students are ready to do the same thing in a given discipline at the same age, and often times students who seem hopelessly lost in a topic early on in the school year end up excelling and even passing up the early starters in the group by the end (Sawyer, Chittleborough, Mittinty, & Lynch, 2013; Welsh, Nix, Blair, Bierman, & Nelson, 2010).
- A fundamental truth that many teachers fail to understand is that different kids are ready for different things at different times because of their age, their past experiences, and their biology (Doherty, 2007; Hertzman & Boyce, 2010).

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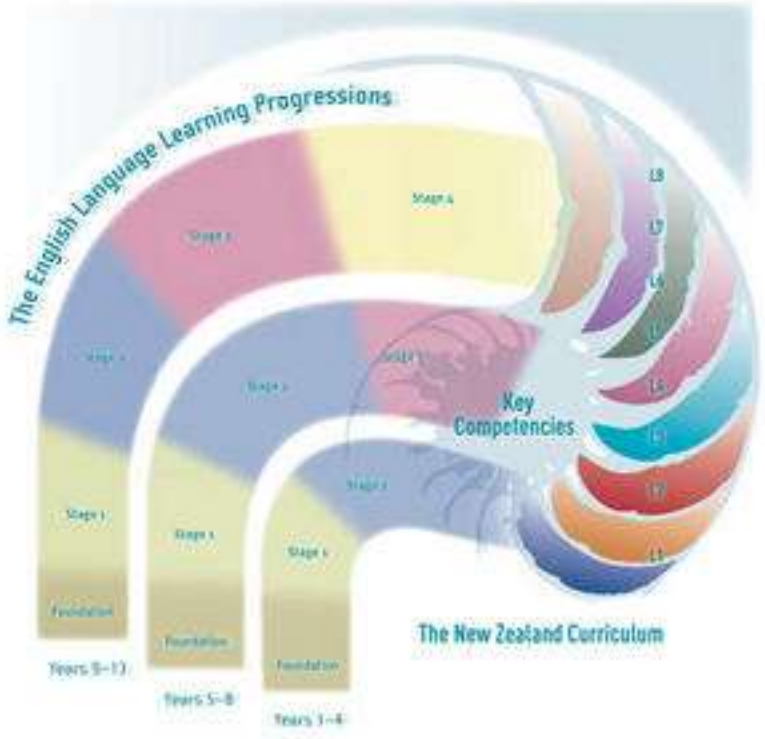
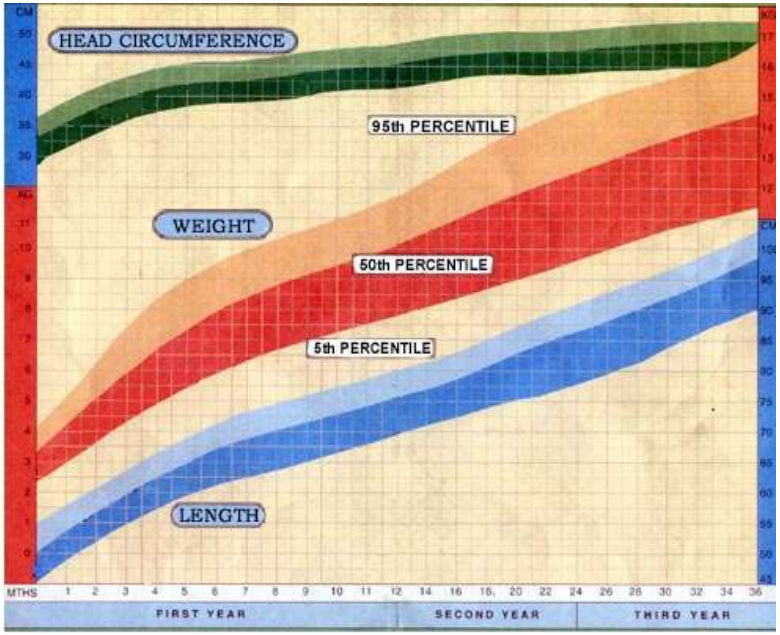


Best Classroom Practice 46. Improve Nutrition

- Approximately 20% of the body's energy is used by the brain (Magistretti & Allaman, 2013) but not all calories are created equal, and not all of them help students' brains learn in the best way possible.
- The body and the brain mutually impact each other (what is eaten by the body influences the brain's ability to learn and the brain in turn makes choices about what to put into the body).



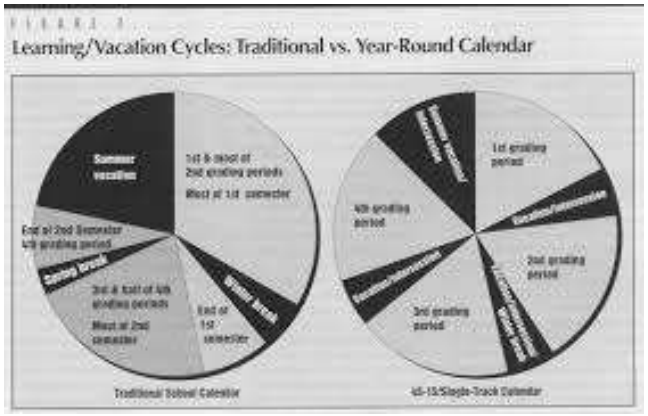
Best Classroom Practice 47. Get Students Out of Rows

- The study of physical ergonomics looks at how humans use their space to achieve processes; there are some physical designs more conducive to achieving certain tasks than others (International Ergonomics Society, 2013). There is a lot to be said about classroom space and our use of it to maximize learning.

- If we know that kids in the back perform worse than kids in the front (because we pay less attention to them, not because they are necessarily any less bright), why don't we do something about this? If we know that seating students in a way in which they can see one another stimulates greater exchange (Marx, Fuhrer, & Hartig, 1999; Rosenfield, Lambert, & Black, 1985), why do we insist on rows if the activity calls for discussion?
- While not all classes call for discussion, those that do are better off seating students in semi-circles than in rows (Wannarka & Ruhl, 2008). Humans thrive on interaction.
- When a person can see another person, the probability of interaction between those two people increases, and when interaction increases, learning increases.

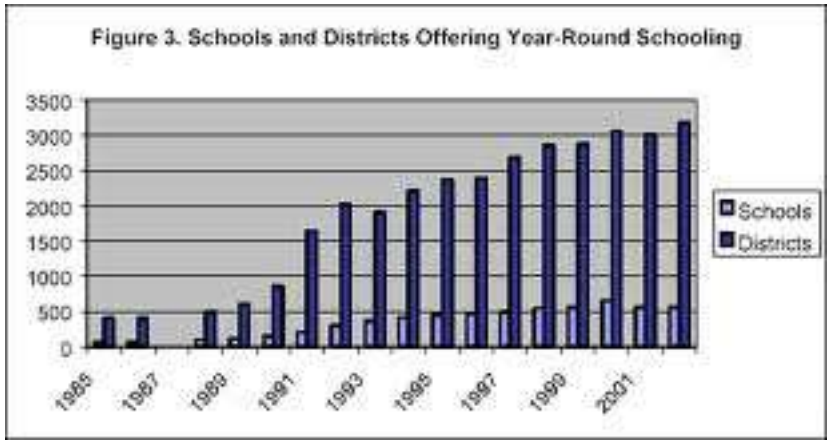
Best Classroom Practice 48. Begin Year-Round Schooling

- The current academic calendar was designed for an agriculturally based society in the 1900s, not a service, technology, and knowledge-based society at the opening of the 21st century.
- Summer vacations were designed to allow children to help with the harvest.



Best Classroom Practice 48. Begin Year-Round Schooling

- Less than 1% of the population in the United States claims farming as an occupation, and only about 2% actually live on farms. And this is a world phenomenon: A smaller and smaller percentage of the world's population engages in agricultural activities.
- In other words, there is a very low likelihood that our students are needed during summer to help on the farm.




NATIONAL SUMMER LEARNING ASSOCIATION

RESEARCH IN BRIEF

Researchers reflect on their work and share the results with you.

More Than a Hunch: Kids Lose Learning Skills Over the Summer Months

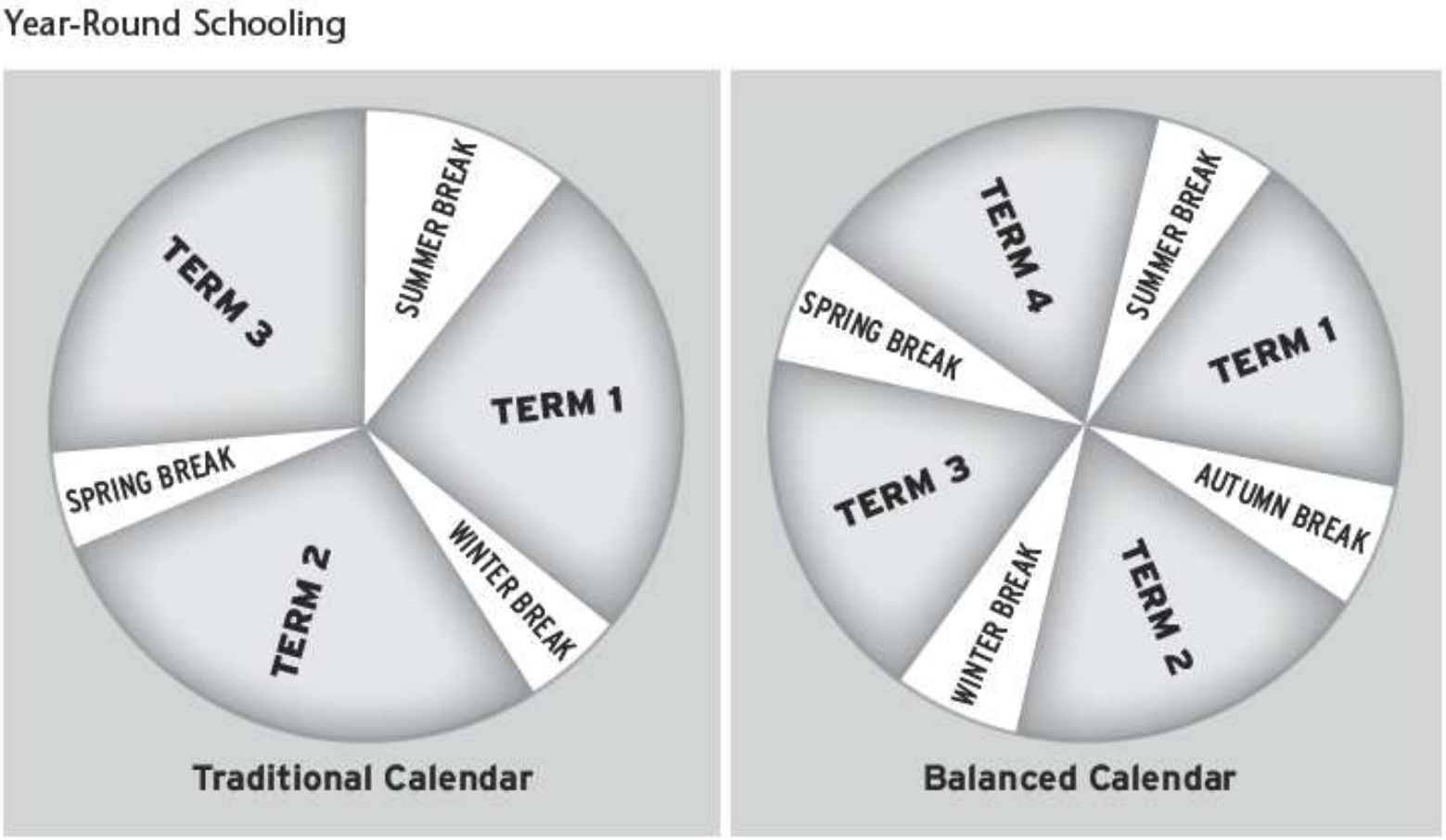
A personal experience can spark a theory that, in turn, prompts important research. That's what happened when Harris Cooper, then a professor at the University of Missouri-Columbia, served on the Columbia, Missouri, school board. In the early '90s, the board was asked to discuss the local implications of a proposed federal cut in summer programming. Cooper, who suspected that the cutback was not a good idea, was unwilling to rubber-stamp the summer programming cut. He launched some research into summer learning, willing to follow wherever it led, and arrived at the overwhelming conclusion that his hunch was spot on. Summer learning loss is very real and has important repercussions in the lives of students, especially those with fewer financial resources.

Ranking (based on effect size)	Domain	Effect size	Measure (intervention, methodology, condition, activity)
146	School	-0.02	Summer vacation
147	Home	-0.12	Welfare policies
148	School	-0.13	Retention
149	Home	-0.18	Television
150	School	-0.34	Mobility

Source: Based on John Hattie (2009; 2012).

- Of all the major influences on learning that were measured by John Hattie in 2012 (n=150), all but five showed some positive learning outcomes, to differing degrees.
- Everything from sitting in class (maturing) to specific teacher interventions such as frequent feedback helps learners. One of the five negative influences was summer vacation. The gap between learning moments (June to August in the Western hemisphere) detracts from the strengthening of memory pathways and, as many teachers can attest, this results in spending the first month of class reviewing the previous year's work just to establish the foundations to begin new work.

- A year-round calendar would service learning needs far better than the current school calendar (Cooper, 2004).

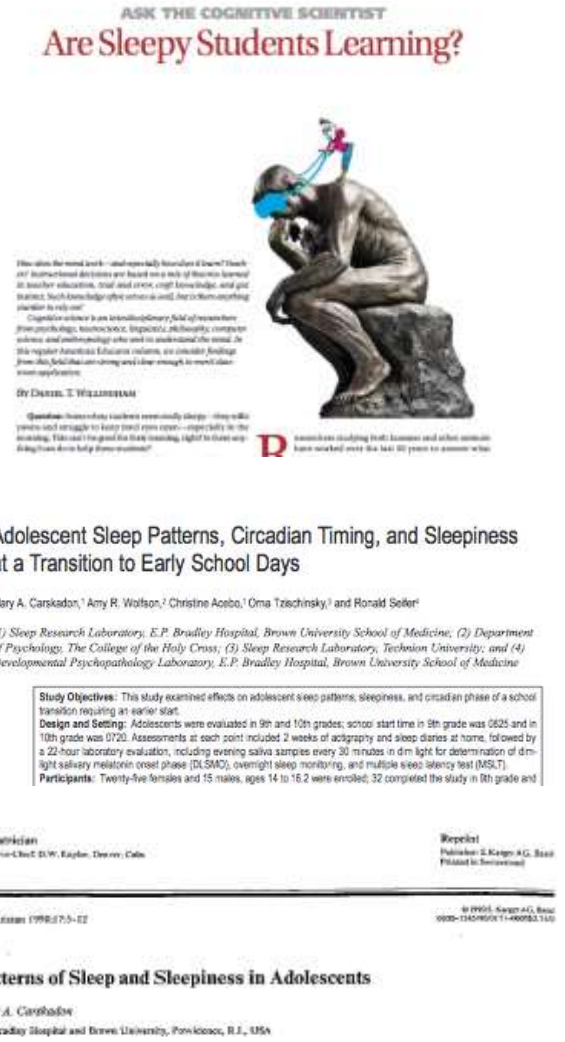


Best Classroom Practice 49. Change The School Day

- We know that early school start times may not be conducive to learning.
- Studies in chronobiology or the study of how different body rhythms are impacted by sleep-wake patterns, show that many students, especially teenagers, experience changes in hormonal balances and prefer later school day starts as they tend to go to bed later (Menna-Barreto & Wey, 2008; Wolfson & Carskadon, 1998).

Best Classroom Practice 49. Change The School Day

- We know that a slightly later school day improves not only learning outcomes, but also student attitudes toward school (for great examples of research in this area, see Azevedo et al., 2008; F.M. Fischer et al., 2008; Golombek & Cardinali, 2008; Menna-Barreto & Wey, 2008; Miller, Shattuck, Matsangas, & Dyche, 2008; Valdez, Reilly, & Waterhouse, 2008).



ASK THE COGNITIVE SCIENTIST

Are Sleepy Students Learning?

Adolescent Sleep Patterns, Circadian Timing, and Sleepiness at a Transition to Early School Days

Mary A. Carskadon,[1] Amy R. Wolfson,[2] Christine Acebo,[1] Oma Tzischinsky,[3] and Ronald Seifer[4]

(1) Sleep Research Laboratory, E.P. Bradley Hospital, Brown University School of Medicine; (2) Department of Psychology, The College of the Holy Cross; (3) Sleep Research Laboratory, Technion University; and (4) Developmental Psychopathology Laboratory, E.P. Bradley Hospital, Brown University School of Medicine

Study Objectives: This study examined effects on adolescent sleep patterns, sleepiness, and circadian phase of a school transition requiring an earlier start.
Design and Setting: Adolescents were evaluated in 9th and 10th grades; school start time in 9th grade was 0825 and in 10th grade was 0720. Assessments at each point included 2 weeks of actigraphy and sleep diaries at home, followed by a 22-hour laboratory evaluation, including evening saliva samples every 30 minutes in dim light for determination of dim-light salivary melatonin onset phase (DLSMO); overnight sleep monitoring; and multiple sleep latency test (MSLT).
Participants: Twenty-five females and 15 males, ages 14 to 16.2 were enrolled; 32 completed the study in 9th grade and

Pediatrician

Reprint

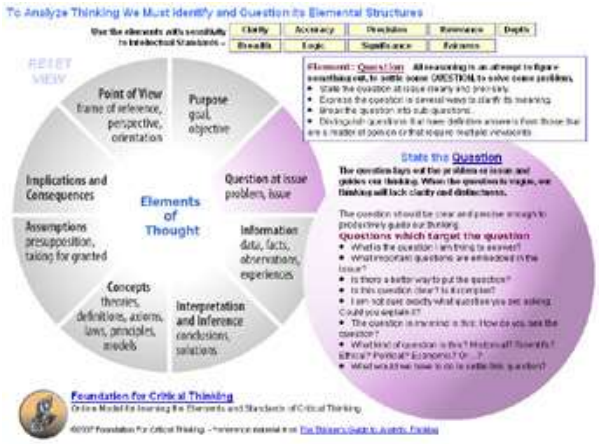
Pediatrician 1990;17:5–12

Patterns of Sleep and Sleepiness in Adolescents

Mary A. Carskadon

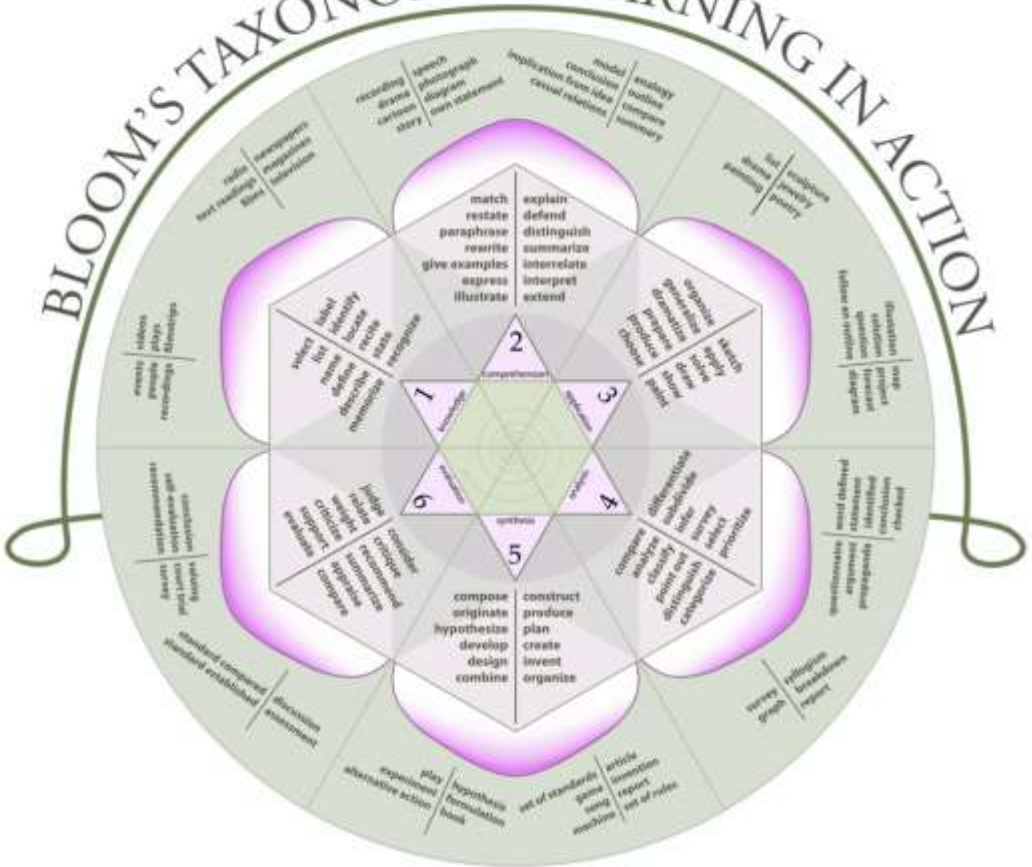
E.P. Bradley Hospital and Brown University, Providence, R.I., USA

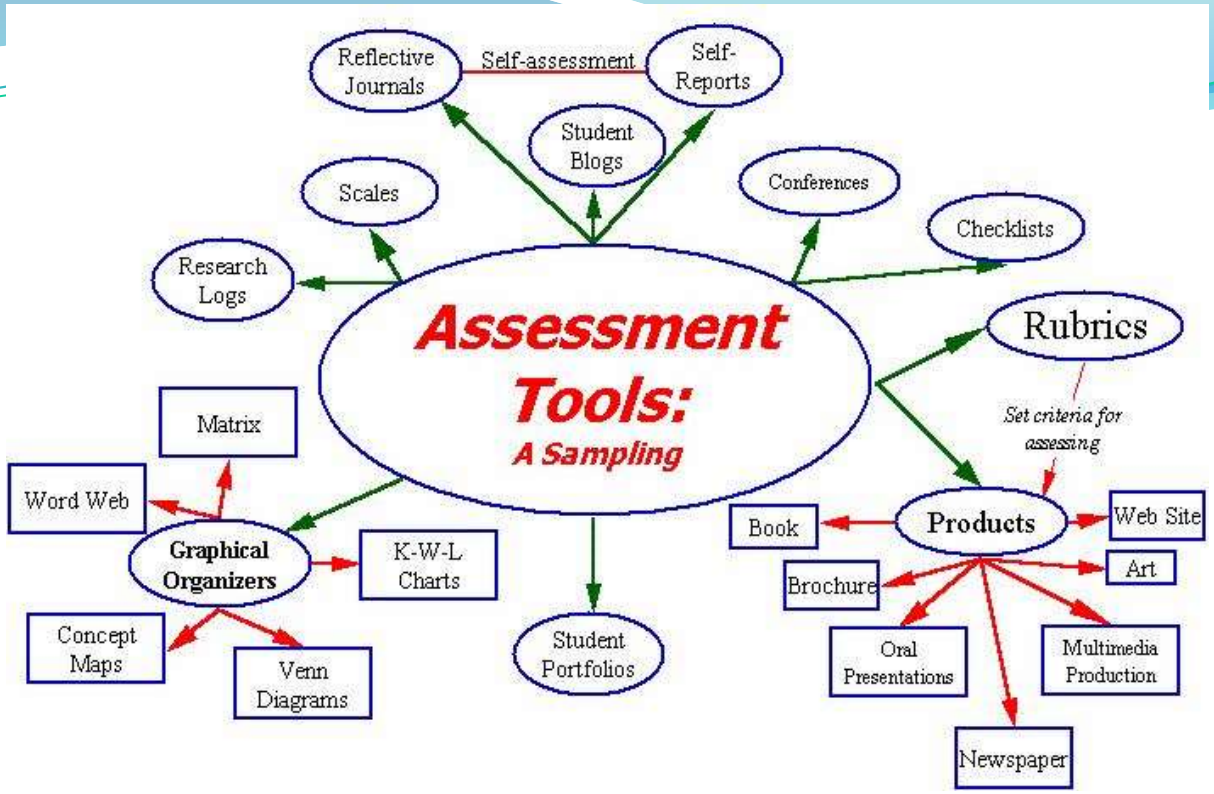
Best Classroom Practice 50. Stop Using Tests as Indicators of Higher Thinking



- We have progressively adapted more extreme testing measures, in many cases presuming that test results are a reflection of teacher efficacy or student learning outcomes.
- **We haven't managed to match our evaluation systems to the types of skills we hope to cultivate in society**.

- High-stakes testing tries to get a lot of information out of a lot of people in a small amount of time with relatively few resources (multiple-choice tests are the cheapest to produce and the easiest to grade). This sounds economically sound, but it ignores the ultimate goal of our educational endeavor: to foster learning. One of the important ideas in MBE is to celebrate, not lament, the complexity of the human brain. Learning is not simple; measuring true learning outcomes cannot be simple either.





- An alternative to high stakes testing is to monitor learning outcomes over time and to document interventions with outcomes. This would offer a much more coherent measure of a school's worth. Why isn't it applied more frequently? Because the least costly tool is education is a multiple-choice test. Long-term studies can't compare. But, you get what you pay for.

Performance Verbs for Learning Objectives / Outcomes

Note: All learning behaviors must be observable and measurable. Do not use vague, nebulous or immeasurable verbs in learning objective/outcome statements.

		Behavioral Verbs	Weighting	Delivery Formats
Level 1 **Knowledge**	**Recall or remember previously learned information without necessarily understanding, using, or changing it.**	**Count** **Define** **Enumerate** Draw **Identify** **Indicate** **Label** **List** **Match** **Name** **Outline** **Point** **Quote** **Read** Recall Recite **Recognize** **Record** **Repeat** Reproduce **Select** **State** **Tabulate** Trace **View** **Write** **Mark**	1	Drill & Practice; Online self-study; Traditional Classroom;
Level 2 **Comprehension**	**Understands the meaning and interpretation of instructions and problems to the point of explaining a problem in own words.**	**Associate** Compare Contrast Convert Communicate Describe **Distinguish** Discuss **Estimate** Explain Express Extend Extrapolate Generalize Give examples **Interpret** Infer **Interpolate** Paraphrase Predict **Restate** Summarize **Replace**	2	Presentation followed by practice; Online self-study Traditional Classroom
Level 3 **Application**	**Applies knowledge and concepts learned to solve new, concrete or abstract problems in the work place.**	**Administer** Apply **Calculate** Change Chart **Collect** **Complete** Compute **Control** Demonstrate Deploy Determine Examine **Execute** **Find** Implement Inform Instruct **Modify** **Navigate** **Operate** Present Produce **Relate** **Report** **Show** **Solve** Teach **Transfer** **Use** Utilize	3	Presentation followed by practice; Online self-study Traditional Classroom
Level 4 **Analysis**	**Breaks problems, materials, or concepts into component parts to understand structural relationships and abstract organisational principles.**	Analyze **Break Down** **Categorize** **Classify** Correlate Diagram **Deconstruct** Focus **Distinguish** Examine **Differentiate** **Group** **Isolate** Illustrate Infer **Order** **Organize** Outline **Prioritize** Resolve **Separate** **Subdivide** **Translate** Transform	5	Case Study or other Problem-Solving session, followed by discussion and debrief; Traditional Classroom or Live Virtual Classroom;
Level 5 **Synthesis**	**Combines components or elements together in structures or patterns to create new concepts, meanings, objects, or wholes.**	Adapt **Arrange** **Assemble** **Build** **Combine** Compile **Compose** **Construct** Create Design Develop Devise Facilitate Formulate Generate Incorporate **Integrate** Model **Modify** Negotiate Personalize **Reconstruct** Predict Prepare Produce Propose **Rearrange** Plan **Reorganize** **Restructure** Revise Rewrite **Structure** **Substitute** Write	7	Case Study or other Problem-Solving session, followed by discussion and debrief; Traditional Classroom or Live Virtual Classroom;
Level 6 **Evaluation**	**Uses definite criteria to make assessments and/or value judgments to choose between different applications of concepts, ideas, methods or materials to achieve a given purpose.**	Appraise **Approve** **Assess** Compare Contrast Criticize Critique Decide Determine Defend Discriminate Evaluate **Grade** Interpret Judge Justify **Measure** **Rank** **Rate** **Select** **Test** **Recommend** Support	10	Complex problem-solving sessions using case studies, role plays etc; Traditional Classroom or Live Virtual Classroom;

Novice Level >>>

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>>> Expert Level

Note: Verbs in bold blue suggest assessable drag and drop activities. Verbs in bold orange can be assessed via e-learning. Verbs in grey are difficult or impossible to assess via automated e-learning.

In summary…

1. We reviewed recent new discoveries about the brain thanks to Technology
2. Considered most recent educational research
3. Asked you to consider the move from “Education” to “Learning Sciences”
4. Reviewed the new model of teaching: “Visible Learning” (Hattie) + Mind, Brain, and Education Science (Tokuhama-Espinosa)
5. Considered 50 Best Classroom Practices (Tokuhama-Espinosa, 2014)

Challenge: 3-2-1

- 3 things that impacted you today
- 2 two things so interesting you will share them with someone else
- 1 thing you will change about your practice based on the information shared today

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