Visible Learning and the Science of How we Learn
By John Hattie and Gregory Yates

Part 1 Learning within Classrooms

Chapter 1  Why don’t students like learning at school?  The Willingham Thesis
Daniel Willingham’s book Why Don’t Students like School, is about how students
don’t like school as much as teachers would like. Reasons for lack of involvement in
learning are that kids are stressed and burned out.

- Willingham talks about how the brain does not naturally want to think
  because it’s not great fun, according to cognitive psychologists.

Why is thinking not much fun?
1. Mind not well-suited to thinking
2. It’s slow, effortful and has uncertain outcomes
3. Deliberate or conscious thinking does not guide most people’s behavior in
   real world
4. Instead our brains rely on memory
5. Although we are curious, our interests are restricted to areas where prior
   knowledge is coupled with confidence in our ability to learn
6. We are unwilling to invest any serious level of effort in thinking until we
   perceive a link between immediate effort expenditure and likely success. P. 7

Quality of thinking decreases greatly if cognitive load is too much. Thinking can be
even decrease when a student lacks confidence.

   If student is unsure that they will be successful, they can get discouraged if
   there is awareness of a gap between what he knows currently and what the teacher
   wants him to know. P. 9

   Willingham’s thesis is that the “school way” of thinking does not come
   naturally or happily for many individuals. P. 9

   We have 2 thinking systems—fast-operating which operates out of habit and
   slow-operating which asks to think throughout the day. to be talked about more in
   Chap. 30 Using the slow thinking system throughout the day is tiring, and
   threatening to some students. P. 9

Chapter 2: Is knowledge an obstacle to teaching
Curious detail from scientific literature—teachers’ actual depth of knowledge of
the content of what is being taught bears little relationship to the attainment level
of their students. P. 11
1. It is NOT the case that one can be a reasonable teacher when ignorant about what is to be taught.

2. Having a high level of knowledge does NOT mean someone can teach this topic well. In fact, it seems that the more you one knows about an area, the more difficult it can be to see the same area from another's perspective. Particularly to be able to explain it to a beginner.

3. Experts can become insensitive to how hard a task is for the beginner.

4. Experts can be poor in cueing and communicating—They sometimes leave out information that is important to the novice.

5. However, those instructed by experts are able to transfer their new skill to a second different task more quickly than those taught by a non-expert.

6. Students, however do appreciate teachers who "know their stuff", especially those who demonstrate passion for their subject matter.

7. Students learn less from those they perceive as ignorant.

Chapter 3: The teacher-student relationship

Need to look at relationships overall—particularly the "empathy gap." If people cannot put themselves in the place of another that is an "empathy gap." When this gap occurs, relationships break down in this situation, e.g. with bullies, people in authority, etc.

People tend to extend a level of empathy to people they perceive as similar to themselves, but not to those seen as different. Feelings of empathy closely follow group allegiances, social identities, and cultural alliances.

Toward positive relationships

- Research shows a critical period for the early years of school for the development of an individual's life adjustment pattern. Establishing positive relationships between young students and teachers has been shown to cascade and results in benefits involving trust and affection.
- Teacher-student relationships have enduring effects.
- Positive teacher-student relationships have deferred, cascading effects that may show up the year or so AFTER the experience.

Closeness and conflict

- Closeness is the emotional context of teaching interactions. This is more under the teacher's control.
- Conflict—teacher-student conflict correlates with students' school avoidance, unwillingness to undertake school-like tasks, decreases in pro-social behavior, as well as increases in conflict.
- Aversive control methods such as punishment, criticism, etc. have only a superficial level of student compliance.
Negative tactics are ultimately self-defeating. Compliance is not a strong educational goal. Application of aversive methods in any interpersonal situation triggers strong emotions and motivations which take the form of resentment, anger, general negativity etc. [How does this figure in to what we do in special ed? QUESTION MINE.]

School as buffer—
- School can be a buffer when the outside environment is not supportive to provide a source of social and cultural learning.
- The quality of teacher-student relationship can depend on how much time teachers interact with individual students in a non-coercive and friendly manner.
- Good home and parental factors can buffer effects associated with less-than-optimal teacher-student relationships.

Chapter 4 Your personality as teacher: Can your students trust you?
- Students value being treated with fairness, dignity, and individual respect.
- They monitor teachers’ nonverbal behavior, particularly as to how teachers treat people.
- Telling lies undermines all positive relationships

Blink Effect (Malcolm Gladwell)
- Students evaluate teachers after exposure to them for remarkably short durations, as brief as 10 seconds.
- Students even do better on standardized tests in a friendly, warm environment.
- Teachers are really good at detecting lies of kids at the rate of 60% accuracy
- We detect emotions very rapidly and it affects how we react.

Seeking help
- Students learn more in classrooms where they can ask for help.
- They are more likely to ask for help in an atmosphere of trust. Asking promotes resilience. Students are more likely to seek help from teachers they trust.
- A survey showed that as students get older, they begin to equate question-asking behavior with low ability.
- It has been found that lower ability students ask fewer and fewer questions with increasing grade level, with the implications that these students were
learning that asking questions is a dangerous activity likely to expose one's vulnerabilities. P. 30

- Students strongly value teachers they can trust to assist them when they are struggling with complex ideas.
- Students value teachers who can connect the new with the familiar, convey complex notions in simple terms, who recognize actively that students learn at different rates and need varying levels of guidance, feedback, and instruction.
- Such teaching takes place in atmosphere of trust, affection, and fairness. p. 31

Chapter 5: Time as a global indicator of classroom learning

Student time can be broken into 4 categories

1. Allocated
2. Instructional
3. Engagement
4. Academic learning time

Studies show that students are engaged (time on task) for 36 of 53 minutes

Academic learning time (ALT) varies from 9 to 45 minutes with class median level of 27 in that same 53 minutes

AVG CHILD IS ENGAGED FOR ABOUT ONE HALF OF THE INITIAL ALLOCATED TIME. [CAPS MINE]

 Teachers have the impression that certain students are working well and others not. Excellent teachers don't realize that there may be a four-fold difference in individualized time going on in the class right under her nose.

Research basis

- Academic learning time is important but time itself does not correlate strongly with achievement outcomes
- Time engaged on a task is more critical for low achieving students
- Students' level of success is crucial factor linked to significant gains on both achievement and positive attitudes. [In other words, when a student is successful at learning, they are more likely to learn more and to feel good about it.]
- Research says there is no automatic relationship between time spent studying and student grades. In fact, high achieving students perform well while spending less overall time than others in their studies. P. 40
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- We do know that students who have to cover topics in a hurry without deep understanding are unable to pass written tests that assess for depth in understanding.
- By asking students to race through mandated lessons, we run considerable risk of creating little more than isolated islands of knowledge. P. 41

Chapter 6: Recitation method and the nature of learning

Recitation method is fact of life in classroom life. Criticized because:
- Questions asked are mainly at low level
- Only 1 student is active at any time—majority are being passive
- Education is receiving packaged knowledge from authority figure
- Nature of conversations is recitation is predictable, task-oriented, but unstimulating.

In a study it was reported that 75% of class time was spent on such instruction with teachers out-talking students by factor of three. P. 45

Why has this method survived for so long:
- It's tradition
- It has educated a large population in advanced Western societies
- Other approaches e.g. discovery learning haven't been too successful
- Information technology has not transformed classrooms
- The teaching profession and demands placed on teachers have perpetuated its use
- There is a lack of incentive or competition to change

Advantages:
- Teacher is in control
- Can progress through material at any pace you want
- Can progress with or without feedback
- It provides the illusion of teaching success

Huge problem—students will learn little from merely listening to teachers talk

Problems:
- Interaction is that a single teacher is often interacting with a relatively small subgroup of students within the class
- Some students become invisible.
- It's possible to sit in a classroom and virtually never be noticed.

Studies show that effective teachers explain material extremely well but in brief periods of time (5-7 minutes) whereas a novice teacher would have taken longer.
Studies show that attention and vigilance drop off after 10 minutes.

Students learn more if the new knowledge is connected to prior knowledge. Attaching knowledge to old knowledge for each student is unlikely to be achieved for all at the level of whole group instruction. P. 48

Deliberate strategies need to be used to structure student talk. It isn’t enough to put students into groups and tell them to “talk.” Paideia methods work well here.

Chapter 7: Teaching for automaticity in basic academic skill

When automaticity is lacking there is reduced capacity to think and comprehend
- When we read, we assimilate every word, every letter, within a time frame expressed through split seconds.
  The assumption that reading for meaning hinged upon contextual cues, to the relative disregard of individual word recognition, was undermined by a substantial number of scientific studies in the 70s and 80s

- Efficient reading—eyes fixate on certain words and skip over smaller articles.
- An unfamiliar word will slow you down
- Avg. mature reader -reads roughly 300 words per minute
- Light reading is even faster
- Information-laden material likely slows down to 100 wpm
- Value of speed reading? Opinions vary. People who read at 500 wpm are really skimming
- Conversation is 150 to 200 wpm and recorded books is 150-170 wpm
- If any information flow drops below 100 wpm, there are problems of comprehension.

Toward understanding children's reading problems
- Oral language facility and early phonological skills are closely related
- Oral language develops well before 4 years of age.
- Reading difficulties
- If you cannot understand and process whole words rapidly, at two words a second, then understanding sentences becomes impossible even though you know what each word means.

Cultural progression: from oral facility to accurately reading text
- One of major skills to learn is to process info sequentially—that is, understand the words and then intuit meaning. This is a learned skill but often missing in students who struggle to read.
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• Reading is a major cultural achievement subject to intergenerational forces and social learning factors.
• Across globe—literacy rates vary from 25% to 99% of populations.
• Western society expects every child to be literate
• Literacy skills are not part of our evolutionary makeup
• Our brains are set up to read vocal patterns and social cues, but not to read these strange squiggles on the pages. P. 56

Simple view of reading,
• Many arrive at school without automaticity of sight-sound correlation
• If a child does not engage with reading, and fails to spend hundred of hours actively reading for themselves, then fluency in reading for comprehension cannot develop.
• Inefficient and slow decoding prevents the child from being able to input written info as fast as his or her oral language skills and oral comprehension should allow.p. 57

Parallels in math
• Students should know a basic number of number facts and combinations to reduce mental load.
• When basic skills are automatic, mental space is available for deeper levels of thinking and understanding.
• Knowledge literally provides the mind with room to move, develop and change
• Repetition and consolidation are vehicles enabling knowledge to be stored within retrievable units allowing for mental growth through conceptual mastery and deeper understanding, p. 58

Why number facts are hard to learn
In order to solve arithmetic problems, students need to
1. know how to count
2. know number-to-symbol correspondence
3. know the order irrelevance principle

Deficiencies in upper primary can be predicted by deficiencies in basic computational knowledge within initial 2 years of schooling.

Speed of access in memory functions also predicts confidence and positive feelings. P. 59

Cognitive overload much less likely when students have mastered word recognition and a large repertoire of number facts so that they don’t waste time in the lower levels of thinking. P. 59

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Can automaticity be taught?
- We don’t have a lot of info on how to teach for automaticity which is really about time and repetition.

Chapter 8: The role of feedback

- Students tend to be future-focused, not concentrating on what they did in the past, but what they can do in the future.
- Often what a teacher intends as helpful becomes a personal evaluation in the eyes of the receiver. It is important to focus on how feedback is received rather than how it is given.
- It seems that “bad” criticism is more likely remembered than the good. If the ratio of good to bad events drops under 3, we can expect trouble. There needs a balance of positive and negative.
- Beginners need feedback based on content knowledge, and assurance and corrective feedback
- Intermediate learners have acquired basic concepts but need help linking ideas and extending the ideas, and they need assurances
- Advanced—support self-regulation and help them extend and apply knowledge even further.
- Different types of feedback are necessary for learners depending on where they are. Corrective for novices, process for intermediate, and elaborated conceptual feedback for highly competitive students. P. 66

Making Feedback process more effective
- Feedback is not same as reward or reinforcement.
- Feedback works because the goal is known and accurately defined through realistic assessment

To praise or not to praise
- Praise does not assist you to learn. If you reinforce consistently, learners stop once the reinforcement is no longer present.
- It is more responsible to increase informational feedback while going lean on praise.

When praise discourages effort
- Carol Dweck’s work—effort decreased if praised for being clever or smart.

Feedback in professional world
- Ironic but the more that teachers seek feedback about their own impact, the more benefits accrue to their students.
- Assessment of your students is a powerful way to learn about your impact.
Chapter 9: Acquiring complex skills through social modeling and explicit teaching

Advancing learning is related strongly to quality and quantity of instruction. If teachers model something, it doesn't necessarily translate into learning if students don't interact with the content/process.

- Teachers need to show progressive steps and ensure that learners understand the steps. They can't assume that students understand the incremental steps unless they check for understanding.
- Significant gains target specific tools that students can apply to complex problems.
- Secure knowledge does not automatically come from personal discovery. P. 77 Low ability seem to prefer discovery learning but gain less from it unless they have direct guidance.
- The more the self is involved, the deeper the processing.
- Information assimilated through personal discovery can be shallow, insecure, and incomplete.
- Info communicated through instruction, interpersonal contact, direct social modeling, and verbal transmission can be durable, more securely available, and more strongly validated than knowledge constructed through an individual's unaided inductive processing.
- It is always our personal need to see and hear how other people are dealing with this complexity of learning. p. 79

Chapter 10: Just what does expertise look like?

7 basic traits of expertise (when compared to novices)

- Experts excel only in their own domain (IQ does not predict expertise)
- Experts perceive large and meaningful patterns (They organize info efficiently)
- Experts can work quickly and solve problems with little error (Novices are afraid of making mistakes and experts are less likely to jump to conclusions.)
- Within their domain, experts possess remarkably large short-term memories. (Their working memory expands greatly because of experience.)
- Experts see and represent problems at a deeper or principled level, whereas novices focus on superficial aspects (Not misled by surface features.)
- Experts spend relatively more time analyzing problems carefully and qualitatively (Use their time more deliberately. May appear slower but actually are in deep deliberation mode.)
- Experts have strong skills in self-monitoring. (Novices act like there is one mode to solve a problem but experts see many plans of action and move among them.
Other attributes of experts
Use working memory more effectively
• The more expert they are, the more difficult it can be for that person to describe what the brain is doing.
• Introspection not to be trusted when experts explain themselves to non-experts because they simply do not know how their skills operate p. 89

Chapter 11: Just how does expertise develop

Benjamin’s Bloom study found that experts:
• Had child-oriented parents who dedicated extensive resources to their children seeing this as normal
• Home emphasized high achievement and striking for goals
• High quality teaching sought out by parents at early age
• Child showed high levels of initial enjoyment in the area of expertise
• More time, effort, and money was invested as demands for coaches increased and became highly individualized
• Enhanced commitment realigned priorities and sacrifices
• As potential became more apparent medium-level coaches gave way to master coaches
• Commitment became major life decision

Top performers stay the distance in contrast to others who showed early promise but did not sustain the demands.

Gifted children do not necessarily become gifted adults, and gifted adults were not necessarily gifted children.

Need for practice but what kinds of practice?
• Takes years of practice—around two decades—in highly supportive environment
• General factors such as overall aptitude and IQ have been shown to play virtually no role in predicting elite-level achievement within specific area domains.
• Some people have said it takes 10 years to become an expert but that is flexible. It really takes about 10,000 hours which can be concentrated in fewer or more years
• The type of practice that is necessary is devoted to improvement of a skill as distinct from exercise of that skill.
• Automaticity in a skill can actually impede further progress. What is important is practice to deliberately enhance the skills is what is necessary.
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So what is innate talent?
  • Early talent indicators seldom predict development over the long term.
  • Development is a natural outcome of many interacting factors—motivation, goal setting, persistence, deliberate practice, person identifications and knowledge building.

Chapter 12: Expertise in the domain of classroom teaching

Are there teaching experts?
  • Teachers need to be defined by performance, not years of experience.
  • About 20-30% of student performance is due to teacher effects.
  • Novice teachers—we know—overestimate how much a student can learn in one lesson.
  • Expert teachers are vigilant in monitoring student learning. p. 105
  • Expert teachers are highly accurate at inferring student comprehension from non-verbal cues. [VALUE OF RELATIONSHIPS—NOTE MINE]

Observing expert teachers in action
  1. Experts—possess pedagogical content knowledge that is far more flexibly and innovatively employed in instruction
  2. More able to improvise and be responsive to instructional needs
  3. Understand at a deeper level the reasons for individual student success and failure on a given academic task
  4. More able to provide developmentally appropriate tasks so students aren’t overwhelmed
  5. More likely anticipate and plan for difficulties that may arise
  6. More able to generate accurate hypotheses about causes of student failure and success
  7. Bring a distinct passion to their work. P. 107

Expert teachers often have poorly planned lessons on paper but the more expert they become, the more such plans are familiar scripts with considerable variation and improvisation that they are able to utilize. P. 108

Part 2: learning Foundations
Chapter 13: How knowledge is acquired

Six principles of acquisition
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1. Learning requires time, effort, and motivation—unless the learning is strongly meaningful, relevant and timely, it is subject to rapid and substantial forgetting.

2. Concentration spans are short—If teaching new info, need to do it within 15 minutes or you will “lose them. Attention is easily disrupted.

3. Distributed practice is more effective than massed practice or cramming.

4. Prior knowledge effects are powerful—New information that cannot be related to existing knowledge is quickly shed. Prior knowledge effects readily outweigh the effects due to IQ or so-called “learning styles” which have fairly weak effects on learning. p. 114 When your prior knowledge is based upon misconception, however, it will create an obstacle, an effect called interference. P. 114 Good teachers create advance organizers to activate prior knowledge and provide a place to hang the new knowledge.

5. Your mind responds well to multimedia input. We learn well when we experience multi-modal inputs to learning.

6. To learn, your mind has to be active.

Six principles of memory retention
1. To recognize is easy; to recall is hard.

2. Information given first and information given last are often recalled more easily. called the primacy and recency effects.

3. Over time there are different rates of forgetting. If information is to stay with us, it must be rehearsed constantly or a clear pattern must be perceived for us to memorize nonsense words. For some motor skills, the actions may be retained for a lifetime. But the mind sheds isolated facts very rapidly.

4. Memory is a highly constructive process—it is not just a “playback” function because it is dependent upon the focus of attention at the time of learning. What two people focus upon, given the same experience, can be different. P. 118

5. Principle of savings; what is forgotten can still help. For example, if you learn a second language but don’t use it for a long time, the 2nd time you learn it, it will come back more rapidly.

6. Your memory is subject to interference. It can even be prior knowledge that is faulty.

Five aspects of handling information overload
1. Sometimes there is too much going on in the mind. Sometimes learning is not a pleasant experience. learning can be tough. We often underestimate the amount of time and practice it takes to master a new skill
2. Learning places great stress on mental resources—a learner is vulnerable. Once overload point is reached, the ability to take on new info, is reduced sharply.

3. For all learners, it is crucial to develop coping strategies.

4. Sources of overload can be identified—
   - Low levels of prior knowledge
   - Deficient use of mental strategies or inappropriate coping strategies
   - Unrealistic expectations (overconfidence, goals set too high, etc.)
   - Poor instruction, inadequate teaching or failure to engage with learning content
   - Unfavorable learning conditions
   - Assessment apprehension, e.g. unfair tests, competition, emotional problems.

5. We are all subject to overload—a fallacy is that we can learn more than one thing at a time—Not true. People are switching and any degree of mental switching will cost you.

Multi-store theory—3 levels of memory
1. Iconic—sensory—ultra short term—within a sensory modality (about a second)
2. Short-term or working memory—limited to few items at a time and lost quickly. Within 5-20 seconds
3. Long-term—an archival library—Every mental operation you perform hinges upon ease of access to info you acquired earlier in life. Every time you find an experience meaningful it is because of its relationship to what is already in your head.

Need to develop efficient learning strategies
   - Rehearsal, imagers, mnemonics, elaboration, chunking are all strategies to use to rehearse p. 123

Chapter 14: How Knowledge is stored in the mind

What you already know determines what you can learn and how you think. The effects of prior knowledge are dramatic yet well hidden from a teacher's view.

1. Sensory recognition—Knowing basic shapes patterns and substances, telephone #, etc. Paying attention to fine grain details is paramount. Initial learning fast but the fine tuning discrimination is difficult
2. Strings—simple associations, serial orderings, ABCD. Etc. There is no genuinely defined phenomenon known as 'rote learning' in the science of
learning. Strings are a starting point followed by a relatively short flow of information. We acquire strings through deliberate focus and repetition.

3. Ideas—knowledge as propositions—Ideas link one entity with properties—links at level of conceptual meanings rather than simple strings. We learn new ideas under exposure to factual info. Our existing knowledge is never a passive repository.

4. Schemata: knowledge becomes organized—Schemas are basic units by which we organize and structure our knowledge—get overall big picture. Not easily acquired because the organization becomes more complex. Continues to develop over many years. Refinement hinges on person contrasting successful and non-successful thinking, to make subtle adjustments to accommodate incongruent data

5. Mental models—putting schemata to work—mental model is something you can run entirely in your head, allowing you to simulate reality, allows you to engage in serious problem solving. Models allow if-then thinking to be given free reign. Real-world problem solving depends on 2 factors: availability of accurate knowledge, and ease which stored knowledge can be handled within working memory. Creativity is possible when two or more knowledge sources are integrated in manner not previously recorded. P. 131

6. Procedural knowledge—learning actions—implies sequence of sub goals. Extends to cognitive skills as well as physical or motor activity. Acquisition implies hands-on experiences where person is responding to actual problems. Enhanced greatly by studying partially worked examples. P133

Chapter 15: Does learning need to be conscious, and what is the hidden role played by gesture?

The brain can take in information in the absence of explicit verbal awareness—called implicit learning. Implicit learning is everywhere—social situations, etc.

Learning as unconscious activity—The brain seeks patterns even without conscious words. By some definitions, intelligence is knowing what to do when you do not know what to do. People see patterns before the brain formulates words describing them

Implicit social learning—We learn in social situations and unconscious learning is different from conscious learning in that it is incomplete and is yet to become fully conscious.

Implications of implicit learning—Recognize that learning is not always expressed in verbal forms. Implicit learning results from regularities within
natural world. Our unconscious mind appears especially sensitive to negative information and errors.

*Gestures as a means of uncovering and using implicit knowledge—Gestures are integral part of human communication. They are automatic and evident in all people. When students gesticulate and use their hands as they speak, their understanding of what they are saying can move to a deeper level, and their overall performance on academic tasks can be enhanced.* P. 141

*Gestures as vital aids in thinking and communicating: Your brain will work more effectively when you gesticulate as you talk. Learning is active. On the other hand, behavioral stillness and an overall lack of bodily movement are the well-known correlates of passivity and depression.*

Children are strongly affected by adults' gestures—Infants as young as 10 months attempt to use gestures. How parents react is critical. Students will actively use information that teachers convey through gestures, students can learn more from a teacher who uses explicit hand gestures as teaching strategy, young children rate a teacher as more knowledgeable when she uses her arms to point at significant details.

*Gestures are not effective in conveying abstract topics.* P. 142.

**Chapter 16: The impact of Cognitive load**

**Cognitive architecture:**
- We have limited working memory—around 7 bits of info but operates on only 2-4 elements at time
- Working memory—deals with info a few seconds only—lost within 20 seconds unless refreshed
- Capacity limits apply only to new info obtained through sensory memory
- Working memory has no known limitations when dealing with info retrieved from long-term memory
- Hence, long-term memory dramatically alters both content and characteristics of what is taking place within your working memory
- Long-term memories exist in form of cognitive schema that can vary in degree of complexity and automation
- Your expertise comes from knowledge stored within schema, and not from ability to engage in reasoning using elements that are not stored coherently and organized within long-term memory
• Complex schemata you develop will organize knowledge and dramatically reduce working memory load.

To the expert, a pattern is a single meaningful chunk. To the novice, the same stimulus is a myriad of relatively unconnected facts. P. 147

Coping with complexity—Working memory can be overloaded when dealing with novel or unorganized info. P. 147 if the learning has a lot of interacting elements, it creates high levels of load.

Sources of cognitive load—Intrinsic load—nature of task itself. Can be difficult if confronted with a ton of new info all at once.

Extraneous cognitive load—imposed by learning conditions or instructional context itself.—e.g. if we talk too much to students.

Helping students learn through reducing load—use pre-instructional experience, “flip” teaching, use a series of lessons, instead of one big one, multimedia, redundancy. [Chart p. 150]

Problem with problem-solving—Problem solving imposes heavy load. It is viable when situation is simplistic or involves low levels of item interactivity.
Unfortunately, in the past many educators have asserted that solving problems is one way to learn new material, which is only true if material to be learned is simplistic.

Power of worked examples—Worked examples provide a form of modeling. Novices may be unable to apply the knowledge they acquired unless the worked model is tied to prior knowledge, simple enough to be solved, and not reliant upon knowledge just acquired. Teaching someone a new skill and then expecting that person to apply it immediately to a new and complex situation is too much. P 152

Can groups share cognitive load?
• Individual problem-solving activities hamper learning and schema acquisition for novices
• However, collaborative groups that are well-motivated may be an effective teaching tool.
• Problem-solving demands actually helped learning when students worked within groups of 3.
• Collaborative groups—not a panacea but can overcome some of problems that prevent individuals from learning
Enhancing educational materials

- Learners should not be encouraged to choose which modality they would prefer to pay attention to.
- Cognitive load shows that novice learners suffer when excessive information is conveyed, particularly through unnecessary words. (This happens frequently in introducing mathematics problems on p. 153)

Cognitive load and teaching

- If the learning is moving too fast, or unnecessary information is being conveyed, novices may have difficulty making any lasting schema changes.
- Teachers have to observe keenly to see if students’ brains are under a big cognitive load (p. 153)

Chapter 17: Your memory and how it develops

Your early memories: the role-played by language

- Almost impossible to remember anything before age 3.
- It is important for children to have conversations and use active responding to parents’ talk. When children can make sense of what they are experiencing, through conversations, they are able to attend more fully to the key features of an event, and so encode them more completely than would otherwise be the case. (p. 159)

Going to school—causes profound changes in cognition

- Going to school accounts for regular advances in all cognitive functions, including intelligence or IQ test scores. Children who attended schools were found more likely to:
  - Focus attention more efficiently
  - Perform better on figure-ground perceptual problems
  - Use visual depth perception cues more adroitly
  - Identify abstract patterns in visual stimuli, and locate hidden figures in pictures
  - Group items on conceptual or taxonomic basis and chunk items together when memorization is goal
  - Develop strategies for memorization, such as rehearsal, and recitation
  - Use words spontaneously to help them describe and solve problems
  - Display superior memory performances
  - Are advantaged by up to 6 IQ points per year higher when contrasted against peers not in school
• Going to school alters the way students organize their perceptions, language skills and knowledge storage systems. P. 160

Researchers have established clear linkages between students’ age and their changing org. and rehearsal strategies. With increasing age, children will use their long-term memory system more effectively.

Classroom-based research: do teachers teach memory skills
• 10% of teachers apparently never offered any direct suggestions about memorization strategies—Teachers expect students to memorize but don’t tell them how p. 163 And they should

Chapter 18: mnemonics as sport, art, and instructional tools.

Mental training program—
• can use mental pegs or method of loci—where one tries to remember things in a location and then just visualize he location and you can remember the item

Should we train our memories—the more skills you learn within a domain, the ability to store more within your working memory increases.
• Short-term memory itself is not increased
• But your working memory becomes highly effective

Why do some highly intelligent people think they should memorize?
• They are competitive
• Some feel that our modern education fails to teach people to memorize
• That memorization is a lost art, as essential human attribute
• That mental performances of lists of random items is an indicator of higher order human capacity
• The mnemonic skills have wide applicability in human society and life in general

However none of those 4 beliefs stack up well. Even small computers can achieve these skills. But there is still some need for some mnemonic skills so that the working memory becomes more efficient.

Should we be teaching mnemonics?
Clear and usable techniques should be taught because they are genuine skills that individuals may have to use at some time. P. 170
Range of content-related mnemonics—some excellent teachers use acrostics and acronyms to help students learn some material.

When memorization is taught, children show clear improvements on tasks used within the training but the effects do not generalize. P. 173

Bottom line—memory skills help to learn lower-level surface knowledge but not necessarily the deeper aspects (relating and extending the knowledge.)

Chapter 19: analyzing your students' style of learning

- There is no recognized evident suggesting that knowing or diagnosing learning styles will help you teach your students any better than not knowing.

- There is some evidence that suggests learning styles can influence other aspects of how we might behave but there is not any serious evidence indicating that learning styles can genuinely predict learning in any meaningful manner.

- Learning styles are not the same as developing learning strategies. P. 176

How did this field develop

- Developed out of ability testing during WWI with IQ testing.

- Consequently, there is confusion between the notions of ability and style—Strengths of Ability in one area does not imply that there are weaknesses in other areas.

- A lot of the learning style information is gathered on self-reporting which is indicates preferences but does not mean that the person learns more in that style.

- The notion that one style of instruction can advantage one type of student, but disadvantage another type, remains unsupported by any known evidence and is simply wrong. P. 184

Chapter 20: Multitasking: A widely held fallacy

Multitasking—that the brain can accomplish 2 or more activities simultaneously or accomplishing multiple goals within single time period through switching between tasks, focusing on one primary goal but allowing a secondary goal to assume priority, consciously dividing your time attending to several essentially non-demanding tasks, eg. Reading email.
• There is no validity that the brain can do two things at once. Your attention will be drawn to one of them. What is happening is switching between the tasks.

• Some multitasking is thinking and learning and another is thinking and performing a task already learned. The demands of distractions is far greater on learning something new that being able to use what is already in the head.

• We often compare the brain to a computer in that it can multitask. This is not the case because a computer actually switches between tasks and does so rapidly so it appears simultaneous.

• To put it bluntly, when it comes to actual learning situations, multitasking does not exist. P. 188

• High cost of mental switching—several studies have suggested that younger people and females are relatively less disrupted than older people and males in switching.

• However, people who expect to multitask across activities typically show reduced overall effectiveness. P. 189

• E.G. people can’t watch “crawlers” on bottom of t.v. screen and attend to main story at same time.

Driving the car

• People are unaware that their driving skills are being impaired when using phone etc. -Using phone is equivalent to the effect of an alcohol intoxication level of .08 p. 190

Multitasking and studying: the problem of sustaining attention

• Anything that saps attention is potentially a negative factor in learning and studying.

• Listening to music is a distracter

• In order to focus, study, and learn, recommended context has to be quietness, and lack of external stimulation. P. 182

Is multitasking every helpful? Yes, to relieve boredom

• Performance of a task will fall off after 10-15 minutes. If this is a repetitive task, it might be helpful to switch to another task to create new energy.

• This is not multitasking, per se, and learning is not taking place.

• It is to restore energy and relieve boredom. P. 193
Chapter 21: your students are digital natives. Or are they?

Mark Presky posited a theory that today's students process information in a fundamentally different fashion as digital natives and that teachers and other older learners are digital immigrants.

- However the theory is overstated. This generation is no different in how their minds work. This theory has no known data base.
- The notion that experience with the electronic world advances natural cognitive capacity is a seriously flawed thesis. P. 197
- When it comes to human learning, there simply is no new magic. P. 198
- Computer access promotes opportunities to learn, but does not create learning through any novel or intrinsic mechanisms.
- Using Wikipedia to locate isolated facts about the Boer War is no different than using an encyclopedia as a valuable learning tool. P. 198

Computers in teaching

- Using computers to assist learning as a generally positive effect size of .37 which is about average. Effects are reported at all levels of learning and the effect size has not changed over the last 30 years
- Several important generalizations:
  - Effects stronger when teachers received higher levels of training on computer use
  - Effects strong when computers were used to supplement traditional teaching, rather than as alternative
  - Effects strong when computers offered students opportunities to extend their learning practice periods or utilize tutorials
  - Clear advantage when students had control over pacing and mastering new material
  - Computers were most effective when used in pairs
  - Computers have the ability to provide highly adaptive feedback
  - Students learn more when the work in pairs using technology. P. 199

Chapter 22: Is the Internet turning us into shallow thinkers?

- We are using the Internet in an evolutionary, not revolutionary, fashion. We are learning to balance the old and the new
- The way we think, feel, and learn, owe far more to the basic language, interpersonal behaviors, and essential we encounter within our infancy and preschool years, than they do to any recent technological development. P. 204
How Music impacts on learning

What is effect of background music?
• Appears to be no overall relationship between the presence of background music and the actual learning when people are engaged on non-musical tasks. People do not learn any better or worse because of gentle music playing quietly in the background.
• However music can be irritating and distracting.
• Music can alter mood to calm and relax and induce positive emotions.
• Some children benefit from application so music therapy.
• Driving performances improved when people allowed to listen to preferred music CDs.
• Advantage in medical settings too—lowers anxiety in invasive surgery parents.

Is there a Mozart effect?
• It's well researched by unproven.
• Classical music may help keep you alert and awake but will not boost intelligence. The arousal effect is similar to drinking a cup of coffee.

Does music instruction have any benefits for student learning in non-musical areas?
• Students who practice music a good deal tend to perform well in school and have higher IQs.
• It has also been found that the more intelligent a child, the more likely he or she is to receive music lessons.
• The links are well-nigh impossible to untangle because of the number of variables.
• However, one researcher, Sylvain Morena, has been able to demonstrate links between children's experiences in music, their auditory skills, and making fine-grain discriminations in second language learning. p. 209

Part 3: Know Thyself
Chapter 24: Confidence and its 3 hidden levels

• Boys, more than girls, demonstrate higher levels of academic confidence when it may not be justified. P. 215 Called over confidence.

• As teachers we look at level of confidence students display when diagnosing what students know.

• Confidence has been investigated in 3 ways: 1. Self-esteem, 2. Perceived competency, and self-efficacy.
Global personality confidence: your self-esteem

- Involves beliefs about our own self-worth
- Several theories said we should try to elevate a child's self-esteem and that would alleviate crime, teenage pregnancy, etc.
- However, all of the programs to elevate self-esteem did not impact learning or other social ills.
- In essence, every social problem can be ascribed to people's lack of self-regard.
- The theory is interesting, optimistic, challenging, but wrong. p 217

Cracks in self-esteem theory

- Self-esteem comes from being successful in school, rather than the other way around. Self-esteem increase is natural outcome of successful life adjustment, rather than being its root cause
- Another issue—remarkably few individuals can be located who genuinely present with objectively low self-esteem within general population.
- Unfortunately, elevated levels of self-esteem are document in social pathology such as crime, amoral conduct, inconsiderate behavior, aggression.
- Such things are not the result of high esteem but those with high self-esteem typically are less afraid of acting in self-interest p. 218

Confidence through perceived competencies

- Perceived competencies are measured by asking people to respond how confident they feel about certain areas. The reality does not line up well against actual indices of same competencies. Inflation effect
- Relationship between global self-esteem and perceived competencies—depends on the values in your life circles. E.g. if your family values academic performance and you don't feel good about that, then self-esteem suffers. However your self-esteem won't be affected if you are lousy at tennis and your family does prioritize this.

Third level: self-efficacy on the task

- Self-efficacy is related to the task. It's an actual judgment made in real time rather than a feeling about what type of person you think you are.
- Actual ability and self-efficacy beliefs are not perfectly aligned

Distinguishing genuine self-efficacy from grandiose self-affirmation

- Self-affirmation can help some people persevere and accomplish a task and lead to self-efficacy.

Where does self-efficacy come from?
• Telling someone they “can do it” is not appropriate if the internal message they are telling themselves is that they can’t. Encouragement works, not so much through persuasion as it does at jogging the right memories at the right time. “I know you can do these problems as they are just like the ones you did last week, but a bit harder, that’s all.” Is more effective than saying “You can do this. You’re smart.”

• NOT “I believe in you and expect big of you”—this can be emotional blackmail

• Strong self-efficacy has to be based on accessing and activating the fundamental knowledge needed to be successful

• Self-appraisals don’t have to be accurate to be highly motivating. It can be totally healthy to have a slightly inflated view of one’s ability. P. 223

• Under self-confidence is linked with poor motivation. Low efficacy leads to insufficient effort, leading to poor performance, less mastery learning, which then reinforces the original efficacy perception.

• Addressing such deficits, through direct instruction and structure practice, is a viable means of enhancing efficacy. P. 223

Chapter 25: Self-enhancement and the dumb-and-dumber effect

A key aspect to one’s fulfillment is self-presentation—People who show outward signs of confidence are rated favorably by other people. P. 228

Those who present well, discover they enjoy a raft of social advantages. P. 228

• People are biased to think that other people are biased, but not themselves. P. 229

Self-assessment—can genuine self-assessment be possible

• Self-assessments are poor and frequently less accurate than those made by other people. Others can assess you better than you do yourself.

• People approach self-assessment from a baseline of natural self-enhancement.—accuracy depends on whether or not accurate feedback is available.

Dumb-and-dumber effect—

• If individuals have no feedback and no intrinsic basis for knowing how incompetent they are is called the dumb-and-dumber effect. P. 233

• Students at low end of scale had no awareness they were below average and overestimate performance.

• Top students were inclined to slightly underestimate, especially whenever they find a task is easy for them, assuming it is easy for everyone.
• This is one reason why experts in a field often experience trouble in teaching beginners.

Swimming out of one’s depth
• Incompetent people cannot gauge their incompetence. Tackling a difficult problem creates excessive cognitive load that overwhelms the thinking.
• Example, poor writers as students have difficult time judging quality of their work.
• Those who perform poorly cannot become good judges because a judge needs to base his or her decisions on a secure knowledge base. P. 235

Key role memory plays in dumb-and dumber effect
• One cannot account for what one does not know.

Is elevated self-image good or bad?
• There is no special entity called ‘self-insight’ which is more valid than assessment by other people.
• Spotlight effect -the feeling that one should be the center of attention—also affects their belief and actions in functioning in a group. P. 237
• Depressed people tend to not self-enhance. Which makes counseling difficult

Self-image and social relationships
• Self images need to be positive but “holier than thou” attitudes lead to social disaster.
• If one constantly feels better than everyone, relationships suffer.
• Recent books have studied narcissistic behaviors and find that it is growing. That young people are indicating a reduced willingness to attempt to see the perspective of others.
• However, we have to be careful about making judgments about trends because we tend to overstate and oversimplify. P.240

Chapter 26: Achieving Self-Control
• Mischel’s study taught is that self-control is not only a matter of making sensible choices in the first instance, but hinges on capacity to sustain goal-directed action over time.

• Adults learn quickly that self-control is an aspect of character difficult to attain and can break down easily.

• Self-control is a trait that shows itself across the life span. Those who can delay gratification even get higher scores on the SAT.
• If you want to predict which children will become both wealthy and healthy in their adulthood, their ability to exercise self-control appears the most powerful predictive factor we know about.

• Those who exhibit self-control report more successful social relationships in general, and more satisfying marriages in particular. In successful marriages, at least one partner exhibits high self-control.

• High self-control people have a tendency to try to understand other people and are prepared to show empathy.

• People who rank low on self-control are more reactive and those with high self-control are more proactive.

• Learning self-control, is a matter of social development and learning.

• We learn self-control by: a. learning from role models, seeing role models set goals and achieving them, seeing them persevere.

• Social modeling also accounts for those who see their role models interact with criminal activity, gambling, etc.

• We can teach children self-control by providing practice in IF-THEN situations e.g. If Peter offers me a cigarette, I will say 'no thank you'

• Self-control allows people to move beyond self-interest and serve wider interests of other people.

Chapter 27: Neuroscience of the smile: A fundamental tool in teaching

• People who smile are seen as more generous and likable than others. It is the most easily identified emotional cue seen from a distance. Females are more likely to smile than males. Smiling in classroom linked to smiling at home.

• Smiling can convey multiple messages

• More likely to smile at someone like us.

• There are genuine smiles and fake ones—Those that involve the "crow's feet" are genuine. Genuine smiles tend to be brief, sometimes just a fraction of a second. Those smiles that are associated with a negative emotion can be recognized even by young children
• Expert teachers read their students body language, including real and fake smiles, to use these cues to understand the students.
• students also read the teacher's smiling behavior. A genuine smile is one of a teacher's most valuable tools.

How we read other people: beyond the smile
• We gather other info and judge a) temporary mood, b) stable personality, c) familiarity.
• Mood—within a second of meeting another, your brain will infer how this person is feeling and experiencing the world.
• When you first meet a person, you think they are like other people but as you get to know them, they become more differentiated and that they don't fit into neat categories.

Chapter 28: The surprising advantages of being a social chameleon
In meeting someone, we usually begin verbal interactions. The interactions usually involve taking turns speaking which usually are in the order of a tenth of a second. Timing is a critical dynamic in all interpersonal interactions.
• Body language of how people walk together (or not) it is important to notice if they are walking in sync. When characters move in unison, there is a positive relationship between them.
• Posture matching—when you match posture with another, it implies being in sync with them. Some people try to do this consciously so that others think they are in tune with each other.
• Body language is one of the subtle keys to effective communication.
• Research shows that posture matching can come first, and emotional aspects such as feelings of liking, mutual attractiveness, and rapport, may follow. P. 273
• Chameleon effect—when people are in close proximity, a level of mimicry occurs even though none of the parties may be aware this is taking place.
• The quality of the relationship relates to the level of mimicry
• This mimicry can help build relationships. People even mimic the emotions of the people who are on t.v. as they watch. They smile when the actors smile, and are sad when the actors portray sad events.
• Teachers can use this information to build relationships and create a culture in the classroom that portrays positive intentions and openness. P. 278

Chapter 29: Invisible gorillas, inattentional blindness, and paying attention
• Studies have shown that when someone is under stress, they don't see what is right in front of them. P. 281
The invisible gorilla video by Chabris and Simons is an illustration—only 42% of people who watched reported seeing it.

The blindness effect is increased when a person has consumed alcohol. P. 284

The blindness effect is particularly obvious when there is mental overload.

It can also apply to sounds. If the working memory is fully loaded, then the auditory message may be filtered out.

In a classroom this has several ramifications for teachers when giving directions, focusing attention, etc.

Chapter 30 Thinking fast and thinking slow: Your debt to the inner robot

Studies have shown we have 2 minds (System 1 and System 2—[to see more read Daniel Kahneman. I have book notes]

System 1—handles and responds quickly to unconscious info. Type of learning associated with principles of classical and operant conditioning.

  - Vast bulk of functioning. Allows us to proceed through the day rather mindlessly

System 2—verbal expression and conscious awareness.; comes into play when System 1 is not functioning well. Brings increased heart rate but slowing down to elevate consciousness. Involves effort and is inherently lazy.

The systems work together very well.

Gladwell’s book Blink is a great book about the science behind the two systems and how they work in conjunction.

Chapter 31: IKEA, effort, and valuing

IKEA effect—what you build, you may come to love. Refers to whenever someone takes an active role in the production of a positive outcome, then he or she is disposed toward valuing that outcome more positively, even to the point of overly inflated assessment, which the person believes is true, fair, and correct. P. 306

One reason for this effect—the effort is linked directly into the person's memory of the effort involved

When teachers give feedback, they need to consider this effect so that the students receive the feedback in a constructive manner.

We become precious about what we have, simply because it is ours.

If we can't finish something into which we have put great effort, we do not feel so attached to it. P. 312.