

# Understanding the Digital Generation: Learning Attributes

keynote perspective





# Introduction

Today's world is not the world we grew up in, and today's world is certainly not the world our children will live in. Because of the dramatic changes our world has undergone, the digital generation's children are not the students our schools were designed for and are not the students today's teachers were trained to teach.

This presentation examines the effects that digital bombardment, from constant exposure to electronic media, has on kids in the new digital landscape and considers the profound implications this holds for the future of education. What does the latest neuroscientific and psychological research tell us about the role of intense and frequent experiences on the brain, particularly the young and impressionable brain?

Based on the research, what inferences can we make about kids' digital experiences and how these experiences are re-wiring and re-shaping their cognitive processes? More important, what are the implications for teaching, learning, and assessment in the new digital landscape?

How can we reconcile these new developments with current instructional practices, particularly in a climate of standards and accountability driven by high-stakes testing for all? What strategies can we use to appeal to the learning preferences and communication needs of digital learners while, at the same time honoring our traditional assumptions and practices related to teaching, learning, and assessment?

Participants should prepare to have their assumptions about children and how they learn seriously challenged.



# The Five Apes

Even though the world has and continues to change so dramatically, why is it that in education we struggle with the issue of change? When was the last time something was taken OUT of the curriculum?

Because things keep getting piled on, educators today are expected to be more than just teachers—they are expected to be coaches, psychologists, social workers, and therapists. Parents are dropping their kids off at school and expecting them to be fully formed adults 13 years later. And if anything goes wrong with that student, the school is to blame.

Small wonder that educators continue to struggle with the definition of what it means today to be a teacher and that they struggle with the issue of change. Culturally and socially, schools have changed a lot. But why is change so difficult?

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Let's start with a cage at a zoo containing five apes. Inside the cage, a bunch of bananas are hanging on a string and a set of stairs is placed under the bananas. Before long, one of the apes will see the bananas and start to climb the stairs to get to them.

As soon as they touch the stairs, you take a fire hose and spray all of the apes in the cage with ice cold water until you knock them down and drive them away from the bananas. Sooner or later another ape makes an attempt and, again, all the apes are sprayed with cold water.

Pretty soon, whenever another ape tries to climb the stairs, all the other apes will attack that ape to try to prevent it from going for the bananas because they don't want to get sprayed by the ice cold water—another attempt, another attack, another attempt, another attack. Before too long, all of the apes know what will happen to them if they make a move.



Now, put away the fire hose and the cold water, remove one of the original five apes from the cage, and replace it with a new one. Of course, the new ape will see the bananas and attempt to climb the stairs. To its surprise and horror, all of the other apes will attack that ape to prevent it from climbing the stairs because they don't want to get sprayed with ice cold water. Another attempt, another attack, another attempt, another attack.

Pretty soon the newest ape knows that if it climbs the stairs, it will be assaulted. Next, remove another of the original five apes and replace it with new one. As Yogi Berra says, this becomes déjà vu all over again—the scene will repeat itself—and the first ape we replaced will actually take part in the punishment of the newcomer with the greatest enthusiasm!

Likewise, replace a third original ape with a new one, then a fourth and fifth. Every time a new ape tries to climb the stairs, it gets attacked. Interestingly enough, the apes who are beating him have NO IDEA why they are not permitted to climb the stairs or why they are participating in the beating of the newest ape. After replacing all the original apes, none of the remaining apes have ever even been sprayed with cold water. Nevertheless, no ape will ever again approach the stairs to try for those bananas.

The question we need to ask is *why not?* And the answer is because as far as the apes in the cage know . . . well, that's just the way we do things around here.

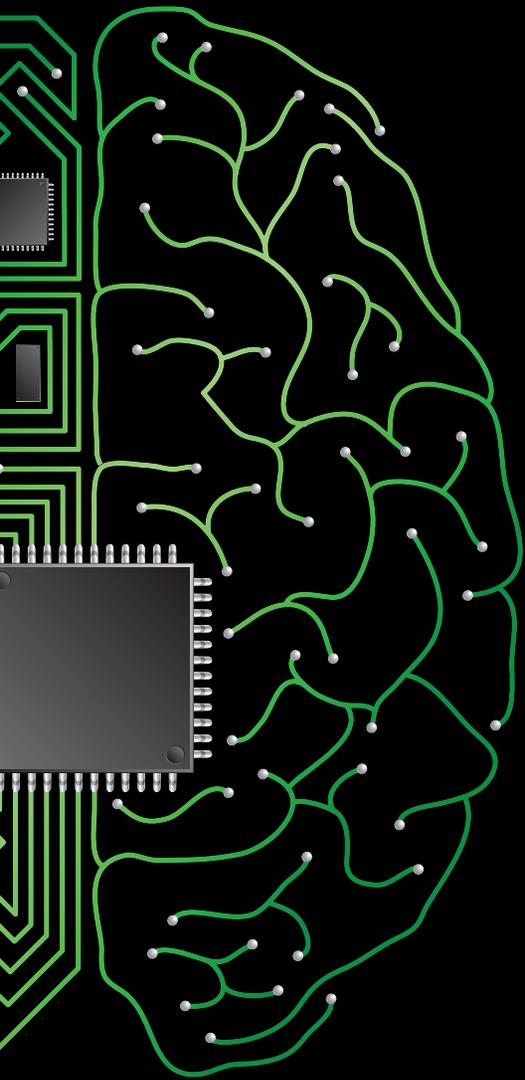
## TTWWADI Everywhere!

The story of the five apes is an example of what we call TTWWADI—That's The Way We've Always Done It. And TTWWADI is everywhere!

It's an everyday part of our lives, in various cultures, communities, core beliefs, our homes, our manners, and many of our assumptions about life in general.

Here's a thought—think we could find some examples of TTWWADI in education?

Think about structure—length of school day/year, the bell system (created by a Benedictine monk 1,000 years ago to manage the hours of prayer), the same “full frontal” lecture style used for the last 100 or so years, the methods of learning assessment—the list goes on.



Today, we face a new kind of student. Our schools weren't designed for them. And our teachers weren't trained to teach them. New technology and global digital growth is affecting today's students.

The changes we faced growing up were incremental and fairly gradual. But for anyone under age 25, change is affected by the present arrival and rapid dissemination of digital technology in the last decades of the 20th century.

There are some interesting books written on the subject of the digital generation and the kids who define it. Some of the more exceptional titles are:

- *iBrain* by Gary Small and Gigi Vorgan
- *The Brain That Changes Itself* by Norman Doidge
- *Everything Bad Is Good For You* by Steven Johnson
- *A Whole New Mind* by Daniel Pink
- *Grown Up Digital* by Don Tapscott
- *Rewired* by Larry Rosen
- *Rethinking Education in the Age of Technology* by Allen Collins & Richard Halverson

The central issue these books address is this: Kids today look pretty much the same as we did growing up, but inside they are completely different. Because of digital bombardment, their brains are adapting to accommodate all the technology they spend so much time surrounded by.

They are what Don Tapscott calls "screenagers"—the first generation that has grown up with a computer mouse or trackpad and the assumption that images on a screen are to be interacted with. These technologies are their new learning tools and also are something to project their very identity onto. They are what Marc Prensky calls "digital natives."

They've developed a "cultural brain" profoundly affected by digital culture. Because of digital bombardment, the brains of today's children are changing physically and chemically.

They are actually neurologically wired differently than we are.



# The Hyperlinked Mind

The kids of the digital generation have developed “hyperlinked minds.” Their brains process information in a parallel or simultaneous manner. We are born with about 50% of our brain wiring in place—this covers critical functions like respiration and circulation. The other 50% happens after birth.

It’s generally been thought that by about age 3, our brains were stabilized and didn’t change much from then on. It was assumed that the same brain you developed by age 3 was the same brain you’d die with. This was supposedly the case for all brains, regardless of any cultural or socioeconomic variables.

However, new scanning technologies have proven many of these long-standing assumptions to be totally false. The brain is, in fact, highly adaptive and malleable throughout life. In addition, our supply of brain cells is constantly being replenished. Our brains are constantly reorganizing and adapting themselves structurally, based on two critical factors—first, the input or experiences we have, and second, the intensity and duration of the experiences.

This means we can change memory capacity, neural processing power, and actually re-grow neurons. Most of all, the intelligence we’re born with isn’t fixed.

This means we can change memory capacity, neural processing power, and actually re-grow neurons. Most of all, the intelligence we’re born with isn’t fixed. There is an ongoing restructuring of the brain; neurons are rearranging current connections, pruning unnecessary ones and forming new ones. This process is called “neuroplasticity,” what Canadian psychiatrist Norman Doidge calls “one of the most extraordinary discoveries of the 20th century.”

# Neuroplasticity

The brain is essentially like plastic, malleable and able to shape itself differently, while also being very resilient. As such, it is constantly creating new thinking patterns. For this to happen, there has to be intensive and progressively challenging stimulation and focus over extended periods of time—we're talking several hours a day, seven days a week.

Does the phrase "several hours a day, seven days a week" remind you of anything else happening in our children's lives? Video games, of course, and today, the graphical rendering in these games is stunning, and solo games have been replaced by online gaming domains like Everquest, Runescape, World of Warcraft, and so on. In these mediums, it's not uncommon for several million players to be working collaboratively to defeat opponents and complete quests. This is digital bombardment—and it's happening several hours a day, seven days a week.

What does this all do to kid's brains? The brain is like a tree—there's a flurry of growth early on, and then over time, unused branches get pruned away or just wither and die. This pruning gives the tree its shape for the future. The same process happens in the brain; cells and connections that are underused or unused get pruned away. Underutilized neural pathways die off.

As new neural connections form, the ones most heavily used become coated with a substance called "myelin." Myelin is a fatty insulating sheath that speeds signal transmission in the brain. A myelin-coated connection will speed neural signal transmission by more than 13 times and with more than 30 times more information per second.

What this means is that the student who spends most of his or her time focused on a specific pursuit, say sports or academics or the arts, will hard-wire and insulate those specific neural connections. But if the same student spends that time lying on the couch playing games or watching TV, those are the cells that will flourish. Connections that are most used or useful develop into a complex, high-speed neural network. Today, even the youngest kids are exposed to many digital devices, and it's this digital bombardment creating the cultural brains in our children. As such, they process information differently than we do. Visual memory, processing, and learning skills are being enhanced in particular.





Digital bombardment has a particularly strong effect on the visual cortex in the back of the brain. A study at the University of Rochester found that visual processing skills increase with as little as 10 hours of gameplay. Tests have further shown that people can remember the content of over 2,500 pictures with 90% accuracy several days after exposure, even though they see each picture for only 10 seconds. Recall rates after one year remain at about 63%.

The same research, however, shows that when information is presented orally, after 72 hours people only remember about 10%. Add picture content to the material, however, and the retention skyrockets up to 65%. With the simple addition of supporting visuals, you could increase students' retention by as much as 650%.

This is because the brain processes images 60,000 times faster than it does text. Our brains are designed for visual content. Of our total nerve cells in the brain, 30% are dedicated to sight, while only 8% are for touch and a mere 3% for hearing.

The brain processes images 60,000 times faster than it does text . . . we are inherently visual learners.

At our core, we are inherently visual learners. It's only natural for our students to be more inclined to process images than text. Their brains are simply designed that way.

And because the digital generation thinks graphically, this research goes on to show that the eyes of digital learners move in a completely different way than the eyes of digital immigrants when it comes to scanning a page or searching for information.

The eyes of older generations unconsciously find an intersection about one-third of the way down the page and one-third of the way in from the left side. This is what the Greeks called the Golden Mean. Then we read in what's called a Z curve (Holmqvist, K. and Wartenberg, C. (2005). The role of local design factors for newspaper reading behavior – an eye-tracking perspective. Lund University Cognitive Studies, LUCS 127 ISSN 1101-8453 - page 4).—a complex Z curve if there's lots of information on the page; or a simple Z curve if there's only a small amount of



information. (Warlick, D. (2007). F-Patterns and hot spots on web pages - <http://www.blackartofwebpublishing.com/FPatternHotSpots>)

However recent research tells us that people consume digital content in a fundamentally different manner than they do traditionally printed physical content. (Nielsen, J. (2006). Jakob Nielsen's Alertbox, April 17, 2006: F-shaped pattern for reading web content. [http://www.useit.com/alertbox/reading\\_pattern.html](http://www.useit.com/alertbox/reading_pattern.html) ) The factors, which include text being harder to read and digitally formatted materials inbuilt opportunity to quickly move to other information (links and searching), results in most of digital readers 'scanning' rather than reading digital content. Nielsen's studies show where people's eyes spend the most time and therefore infer the most heavily consumed content.

Working with Kent State University, Nielsen developed a series of thermographic prints using a heat map to track eye movement of students in different reading configurations and then summed the records. The brighter the color, the more the reader has focused on the information

They're wired for multimedia. Yet the majority of student examination content continues to be text- and vocabulary-based, fixated on content recall.

in that area; and the darker the color the less the reader had focused on that area.. The images, which can be seen at [www.useit.com/alertbox/reading\\_pattern.html](http://www.useit.com/alertbox/reading_pattern.html) also illustrate that digital readers read in the F-pattern. (To view of video of F-pattern reading, see [http://sethgodin.typepad.com/seths\\_blog/2006/05/what\\_i\\_learned\\_.html](http://sethgodin.typepad.com/seths_blog/2006/05/what_i_learned_.html)).

Once digital readers have consumed the compelling images and strong colors of a page, their consumption of text content tends towards two horizontal passes and a slow vertical pass creating an F-shape. Different color and dwell settings on eye-tracking equipment turn this 'F' shape into a triangle that points to the top-left corner of the page. Google (and others) call this the 'golden triangle'. (See <http://www.blackartofwebpublishing.com/FPatternHotSpots>)

Since an increasing amount of information is being delivered in a digital format, it is critical for educators to understand that young readers unconsciously use different very different eye



movement patterns when browsing a text-based page than they would to read things presented in a digital format .

The vast majority of students in any given classroom are no longer auditory or text-based learners. Because of the effects of digital bombardment, they think graphically and are, therefore, either “visual or visual kinesthetic” learners. They’re wired for multimedia. Yet the majority of student examination content continues to be text- and vocabulary-based, fixated on content recall.

Meanwhile, new technologies are changing our children and how they learn. Game consoles and cell phones are replacing TV, and the Internet is replacing traditional schools as a learning source. In fact, author Marc Prensky calculates that by age 21, this digital generation will have

- played more than 10,000 hours of video games
- sent and received 250,000 emails and texts
- spent 10,000 hours on phones
- watched more than 20,000 hours of TV
- seen more than 500,000 commercials.

Growing up, we and our parents had almost none of these experiences that our children have today. Do you think this might influence the way the digital generation thinks? Or learns? Or views the world? Or what interests and engages them? Because, as Prensky points out, at the same time, they will have spent less than 9,000 hours attending school and spent less than 4,000 hours reading, with much of that time spent either unengaged or under-engaged. Digital learners think and process information differently than we do, and use different parts of the brain. As a result, they have different preferences for learning.



# Learning Styles

It's time now to compare the learning preferences of digital learners to our old TTWWADI-based teaching style, which is still used by many teachers today. There are eight key preferences.

**Digital learners prefer receiving information quickly from multiple multimedia sources. Many educators prefer slow and controlled release of information from limited sources.**

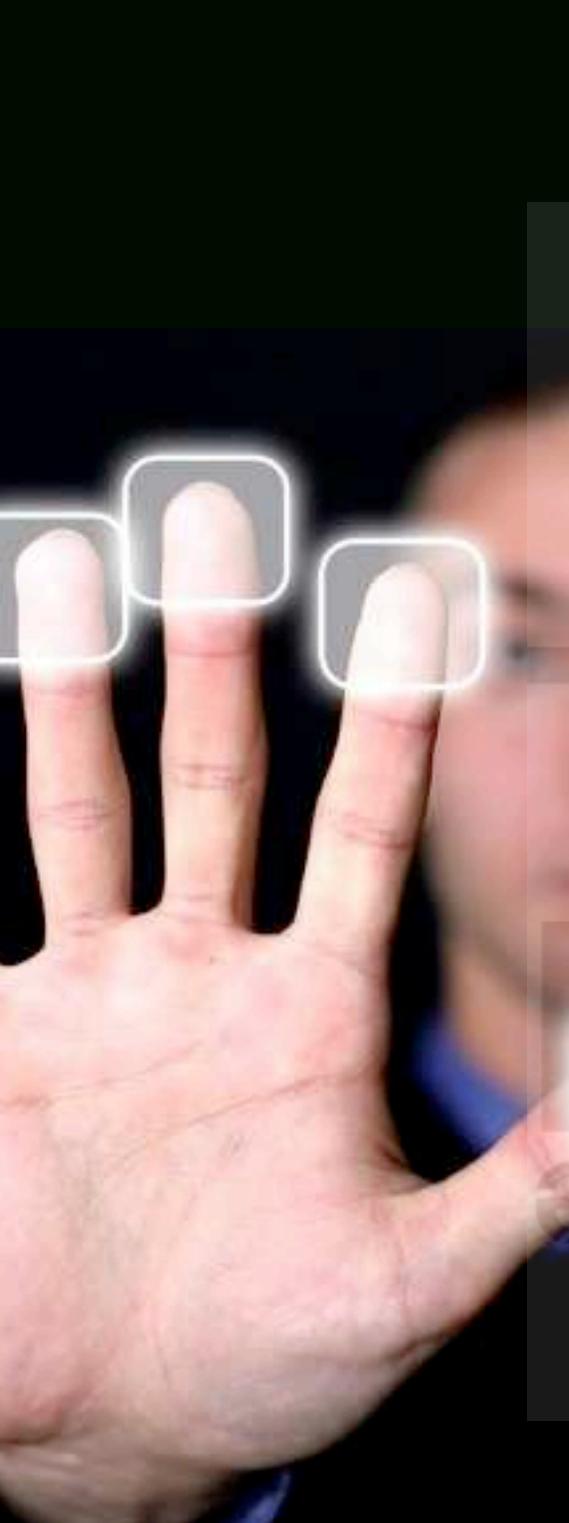
Digital learners operate at twitch speed due to exposure to video games, hand-held devices, hypertext, etc., and as a result, digital learners have had more experience processing data and high-speed information quickly than we have. Many of our teachers today haven't had that experience and, as such, feel comfortable processing at the same conventional speed they have learned and taught with all their lives.

Imagine how the digital learner feels. After wandering the digital landscape while managing chats, updating Facebook, watching a video, and listening to music, students come to school and are confronted by the awesome power of the overhead projector and the whiteboard.

**Digital learners prefer parallel processing and multitasking. Many traditional educators prefer linear processing and single or limited tasking.**

Digital learners like to multitask and absorb through parallel processing. They are comfortable doing several things at once. But our schools still focus on processing one thing at a time, which is a very traditional and linear approach.

Multitasking is technically "continuous partial attention," and we all do it. We can be driving, listening to music, thinking about the day and looking at billboard. But with the digital generation, it all happens much faster. We were told growing up that the best way to study was to isolate ourselves from the outside world and its ambient distractions, and focus solely on the task at hand.



Walk into a child's bedroom today, and what do you see? He or she is working at the computer, burning a CD, doing homework, listening to music, and searching online, while managing 14 instant messenger conversations—and still bored.

**Digital learners prefer processing pictures, sounds, color, and video before text. Many educators prefer to provide text before pictures, sounds, and video.**

For generations, graphics have been static images accompanied by text for clarification. The images were there to complement the text. Today, advances in interactive digital imagery and animation has put the text into the secondary role.

Since childhood, the digital generation has been exposed to TV, videos, and computer games offering high-resolution color images and expressive graphics with little or no accompanying text. These images are powerful enough to get the message across on their own.

Digital bombardment has sharpened kids' visual abilities, which reinforces the point that today's students are primarily visual learners.

**Digital learners prefer random access to hyperlinked multimedia information. Many educators prefer to provide information linearly, logically, and sequentially.**

Many educators provide information in a traditional way—linearly, logically, sequentially, and very left-brained. The digital generation is first to experience hypertext and “clicking around” in electronic applications. This new information structure has increased their awareness and ability to make new connections, freeing them from single-path thought. This is generally a good thing, but it can be argued that hyperlinking may make it more difficult for students to follow a linear train of thought. Their rationale says, “Why should I read something beginning to end and follow someone else's logic when I can explore and create my own?” The truth is that both sets of skills are essential. Following one's own path is important, but so is understanding someone else's logic. We must find a balance.



**Digital learners prefer to network simultaneously with many others. Many educators prefer students to work independently before they network and interact.**

When we were students, we were generally required to work and be evaluated independently of others. Out of school, the primary ways of communication were either face-to-face or by phone. Digital students have grown up with dozens of ways to communicate—cell phones, texting, email, blogs, social networking sites, and Twitter, just to name a few. They need and expect to be able to communicate with others using the digital weapons of mass collaboration.

**Digital learners prefer learning “just in time.” Many educators prefer teaching “just in case.”**

Educators are saying you have to learn this “just in case” it happens to be on an exam, “just in case” you might need it to pass the course, “just in case” you may want to become an engineer, or a historian, or a writer.

Digital learners, however, want to gain an understanding of what they need to know, but they want to acquire these skills “just in time” to play a new game, play the piano, fix a bike, or something else they don’t know how to do.

“Just-in-time” learning is about learners having the skills and habits of mind that allow them to learn and adapt “just in time” for that next window of opportunity that opens up to them.

**Digital learners prefer instant gratification with immediate and deferred rewards. Many educators prefer deferred gratification and delayed rewards.**

Many educators prefer to delay gratification. The idea is that if you study hard and keep focused, you’ll eventually be rewarded with a good grade or acceptance at a good school.

Are you beginning to understand why digital culture resonates so strongly with today’s kids? It provides them with what they need most. Just like we did, they want affirmation, attention,



and the chance to distinguish themselves. Video games and digital technology tell the user that if they put the time in, they will be rewarded with the next level, a win, or a place on the high score list. What they do determines what they get. New technology is all about instant feedback, and the feedback is extremely clear.

**Digital learners prefer learning that is relevant, active, instantly useful, and fun. Many educators prefer teaching memorization in preparation for standardized tests.**

Many educators are compelled to teach strict memorization of curriculum content in order to prepare students for standardized testing. The aim isn't what it should be—cultivating the higher-order thinking skills these kids will need when they leave school. The digital generation is often criticized for being intellectual slackers, when the truth is they are a very intellectual problem-solving group. In fact, many video games contain the complex thinking, spatial relationships, and problem-solving tasks they enjoy. The digital generation wants learning to be useful and relevant. They want to know what connection it has to their world. Most of all, they want learning to be enjoyable.

## Houston, We Have a Problem

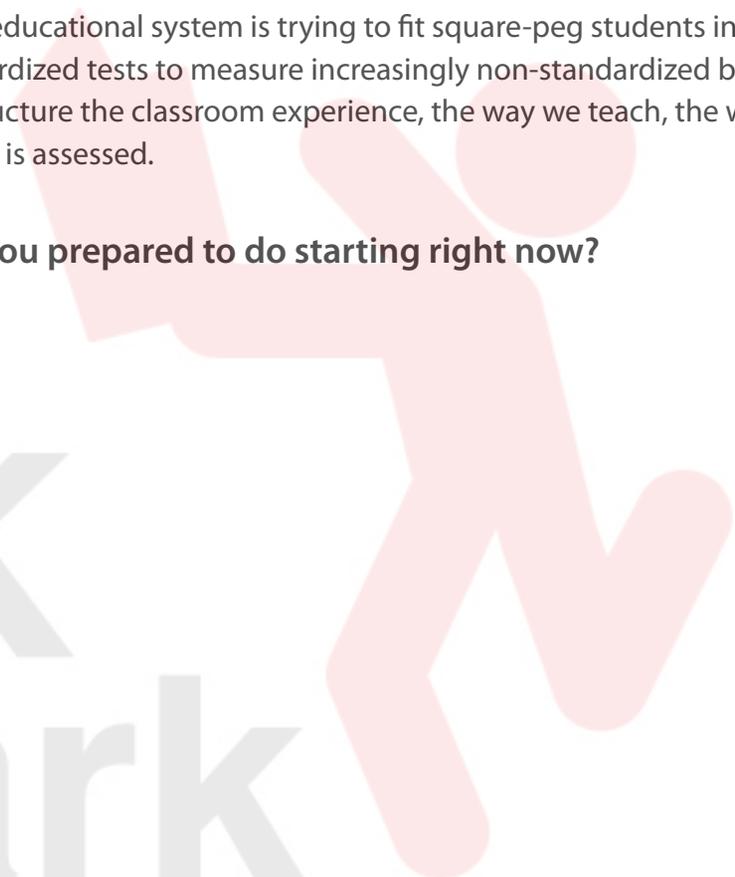
No other sector ignores its own research as much as education. We know that teaching-as-talking doesn't work. We know that project-based learning is dramatically more effective in helping students to learn and retain information. We now know a lot about why kids act, learn, and view

If we continue to do what we know doesn't work, then who here really has the learning problem? Is it the students or is it US?

the world differently than we do. Yet sadly, little of what we know is being applied to classroom instruction today.

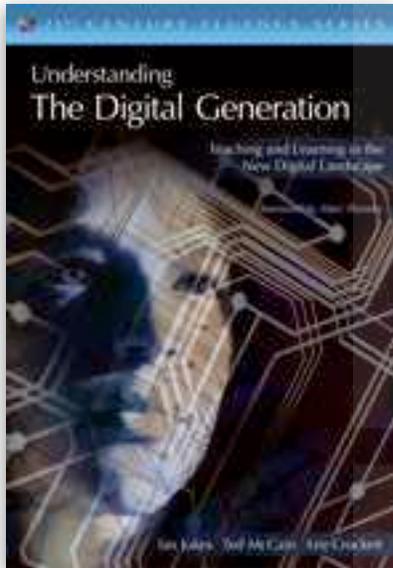
The current educational system is trying to fit square-peg students into round-hole schools and using standardized tests to measure increasingly non-standardized brains. We need to consider how to restructure the classroom experience, the way we teach, the way students learn, and how that learning is assessed.

**What are you prepared to do starting right now?**



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