



WHY? BECAUSE THEIR BRAINS ARE BROKEN

**The Adolescent Brain,
Technology,
Management and
Implications for Teaching**

**Dr. Derrick Mears, Ph.D., A.T.C.
Associate Professor of Teacher
Education
Western Washington University**

Derrick.mears@wwu.edu
<http://derrick-mears.pbworks.com>

APRIL 2, 2011

AGENDA FOR SESSION

**How do I
manage them
without
breaking my
brain?**

**Who is this
guy?**

**This is your
brain on
technology!**

**This is your
brain! This is
your brain on
adolescence!**

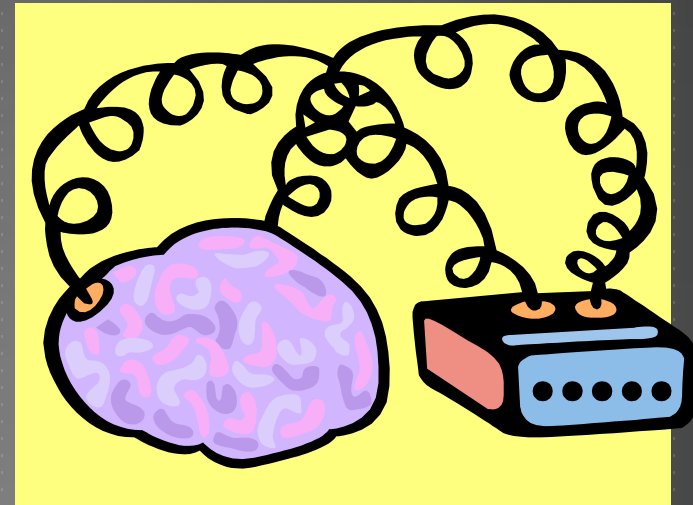
WHO IS THIS GUY?

► *Background:*

- 21 years in education:
 - 12 years in public schools teaching Middle School and High School Science, Physical Education and Gifted Education
 - 8 years in higher education-Teacher Education
 - Pedagogy, Perceptual Motor Development and Educational Technology

THIS IS YOUR BRAIN!

A Typical Day in the Secondary Classroom

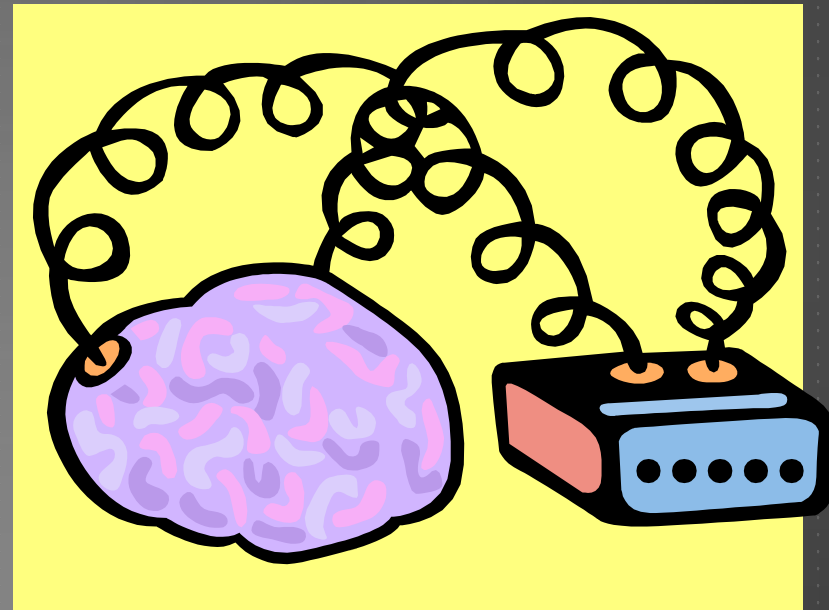


THIS IS YOUR BRAIN!

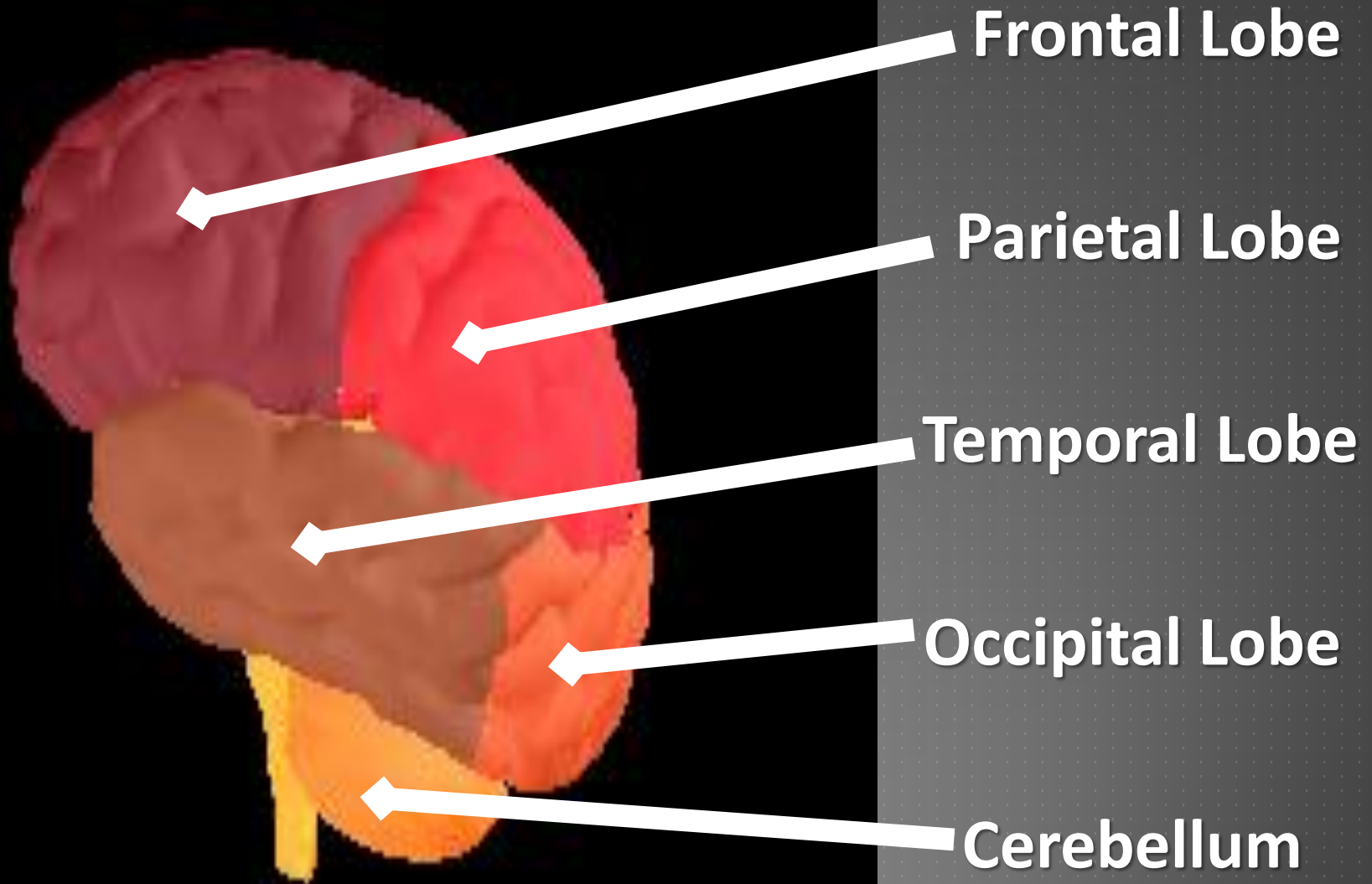
And The Saga Continues.....

Why?

First a look at Brain
Anatomy



THIS IS YOUR BRAIN!



THIS IS YOUR BRAIN: FUNCTIONS OF THE FRONTAL LOBE



Frontal Lobe:

- Creativity
- Judgment
- Planning
- Problem Solving

THIS IS YOUR BRAIN: PARIETAL LOBE FUNCTIONS

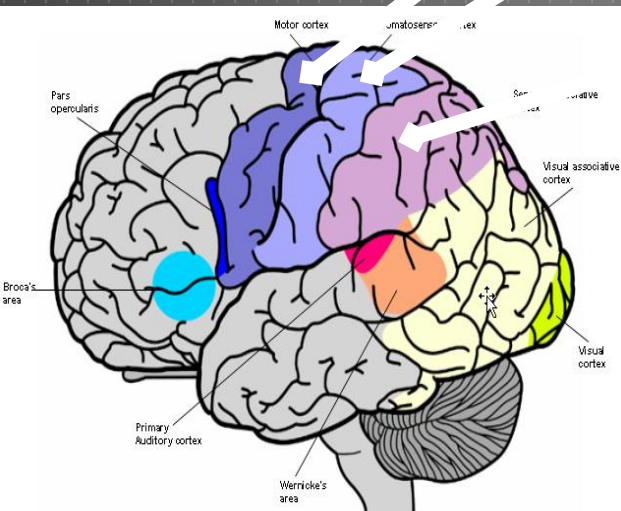
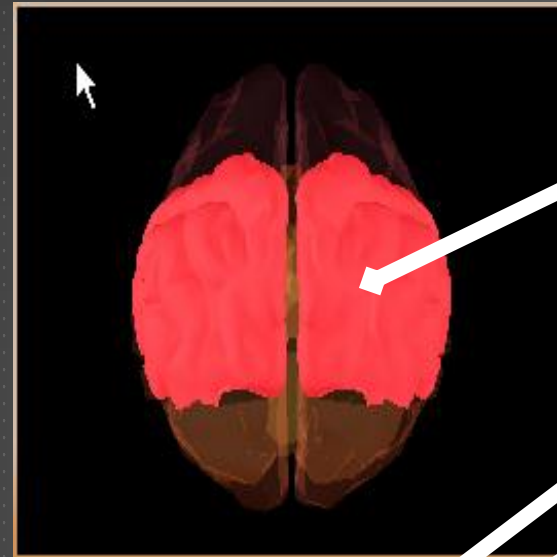
Parietal Lobe:

Pre-motor area

*Primary Motor
Control Area*

*Primary Sensory
Area*

- *Skin receptors*



THIS IS YOUR BRAIN: TEMPORAL/OCCIPITAL LOBE FUNCTIONS



Temporal/Parietal Lobes:

- Processing, higher sensory and language functions, hearing, memory and language.



Occipital Lobes:

- Vision and visual processing areas.

THIS IS YOUR BRAIN: CEREBELLUM FUNCTIONS



Cerebellum:

Coordinates movement:

- Balance.
- Posture.
- Keeping the Body in an Upright Position.
- Speed, Direction, Force.
- Steadiness of Voluntary Motion.
- Memories of motor skills.

THIS IS YOUR BRAIN: AREAS OF MEMORY



Frontal Lobes:

– Long Term Memory

- Concentrated in the thalamus and hypothalamus and the frontal lobes.



Parietal, Upper Temporal and Occipital Lobes:

– Short Term memory of what we hear and see.

THE BRAIN QUIZ!

Brain Kinesthetic Review Structure:

- ▶ **Frontal Lobe-Hands on forehead**
- ▶ **Parietal Lobe-Hands on top of head**
- ▶ **Temporal Lobe-hands over ears**
- ▶ **Occipital Lobe-hands on back of head**
- ▶ **Cerebellum-hands on back of head base of skull**

Brain Kinesthetic Review Questions:

- ▶ **Balance and coordination**
- ▶ **Problem Solving and reasoning**
- ▶ **Information processing, memory and sensory motor**
- ▶ **Hearing functions**
- ▶ **Vision**

THE BRAIN QUIZ!

Quiz # 1-Right Side of the Room

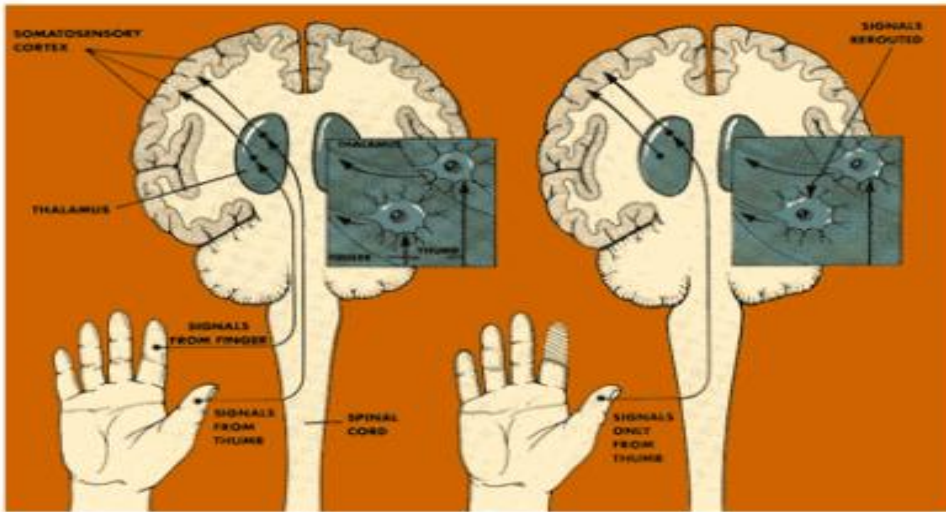
Quiz # 2: Left Side of the Room

Student Response Polls
www.polleverywhere.com

WHY DID WE DO THAT???

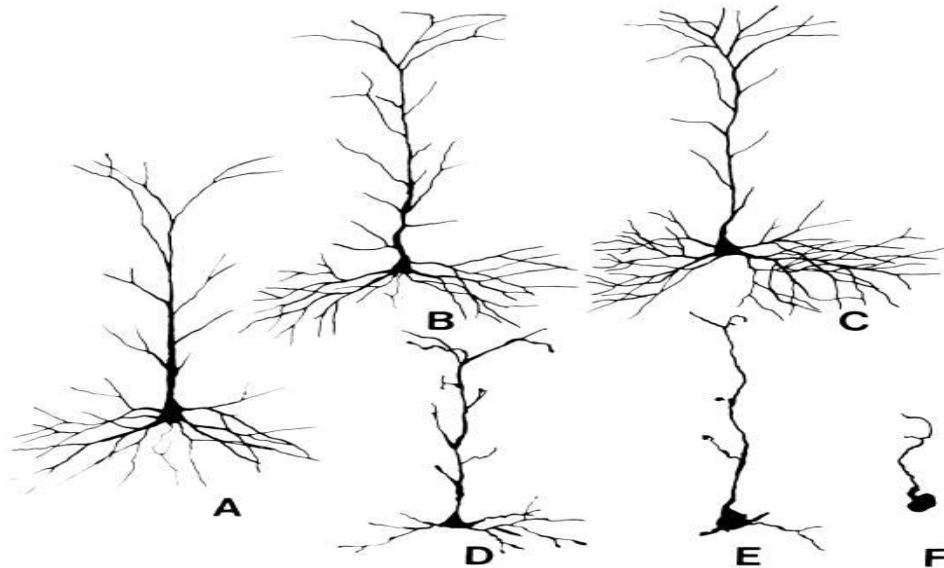
- ▶ *The Brain Needs Oxygen to function:*
 - ▶ *Adding movement to instruction increases blood flow to the brain thus increasing oxygen content to the Brain.*
 - ▶ *Adding a kinesthetic cue sparks retention.*

THIS IS YOUR BRAIN ON ADOLESCENCE: REORGANIZATION AND PRUNING

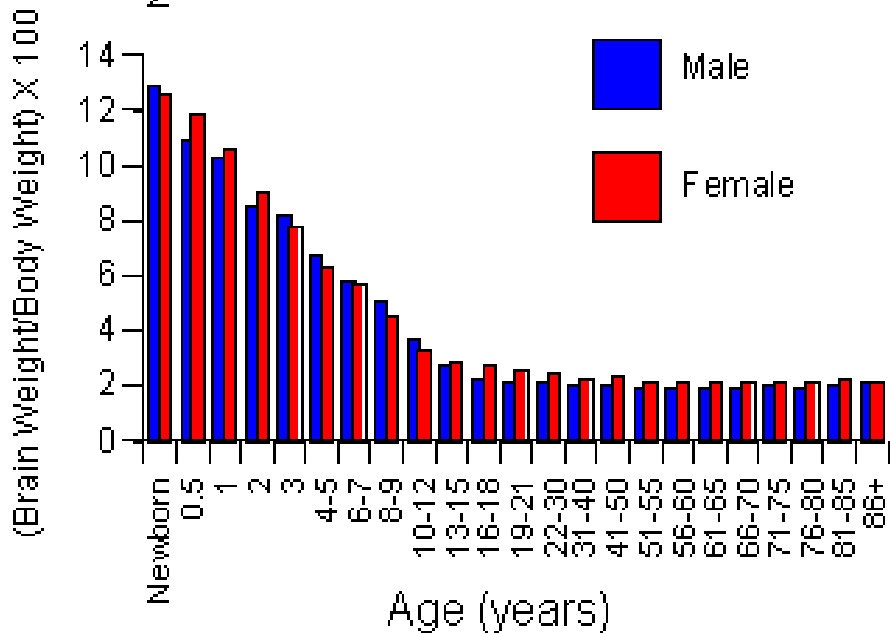
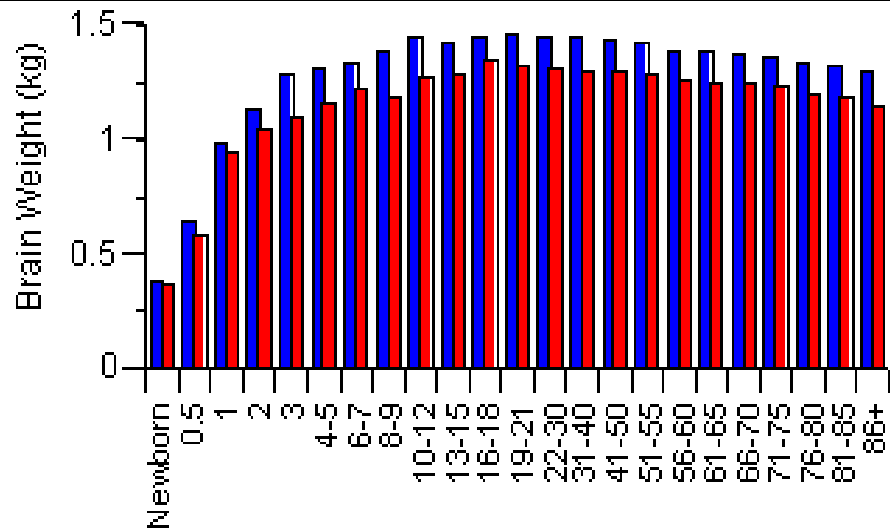


► *Reorganization*

- Connections form in the brain between brain cells for specific sensory and motor patterns.
- The connections that are reinforced are retained, while the ones that are not are pruned away.



THIS IS YOUR BRAIN ON ADOLESCENCE: GROWTH AND REORGANIZATION

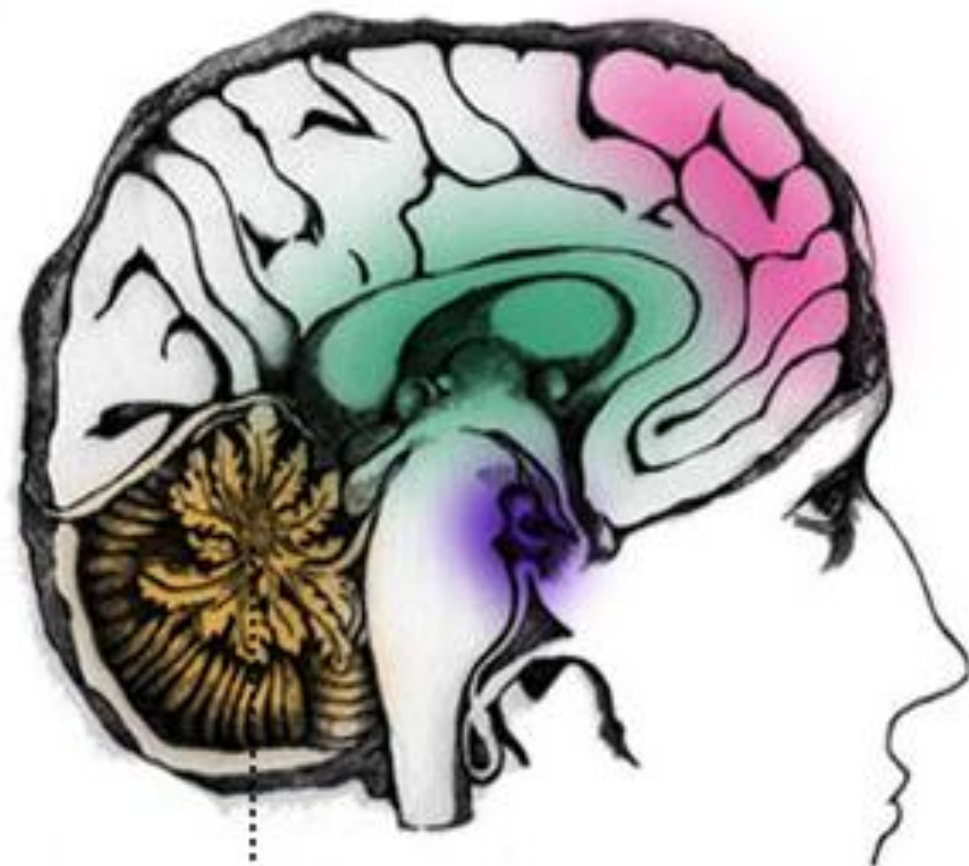


The most active periods of brain growth and reorganization take place in the first two years of life.

- *The brain grows by expanding connections between brain cells (neurons).*
- *The terrible 2's can be explained by this process.*

Anatomy of a Teen Brain

Roll over a part of the brain for more information.

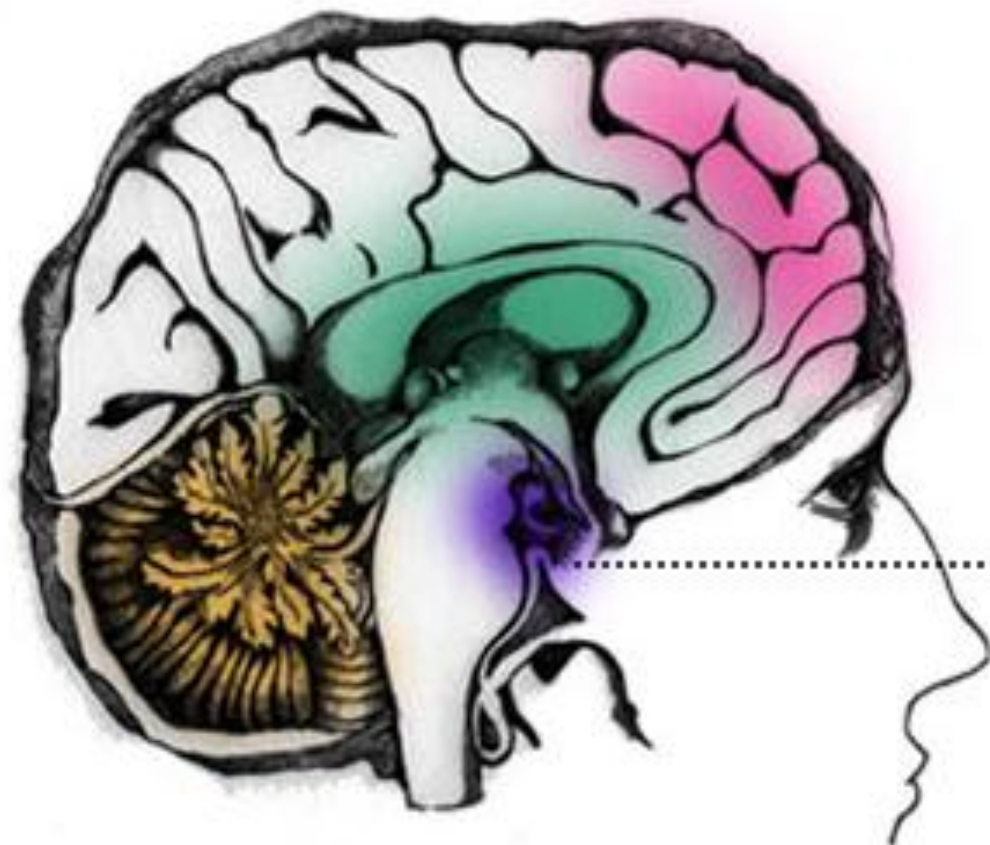


Cerebellum

This part of the brain has long been thought to be involved with the coordination of muscles and physical movement. Recently, scientists have come to believe that it is involved in the coordination of thinking processes, as well. New research has shown that it is an area that undergoes dynamic growth and change during the teenage years.

Anatomy of a Teen Brain

Roll over a part of the brain for more information.



Amygdala

This area of the brain is associated with emotional and gut responses. New imaging studies suggest that teenagers, when asked to interpret emotional information, use this reactive part of the brain rather than the more "thinking" region, the frontal cortex, while adults rely more heavily on the frontal cortex. Scientists speculate that this may be why teens have trouble modulating their emotional responses.

Anatomy of a Teen Brain

Roll over a part of the brain for more information.

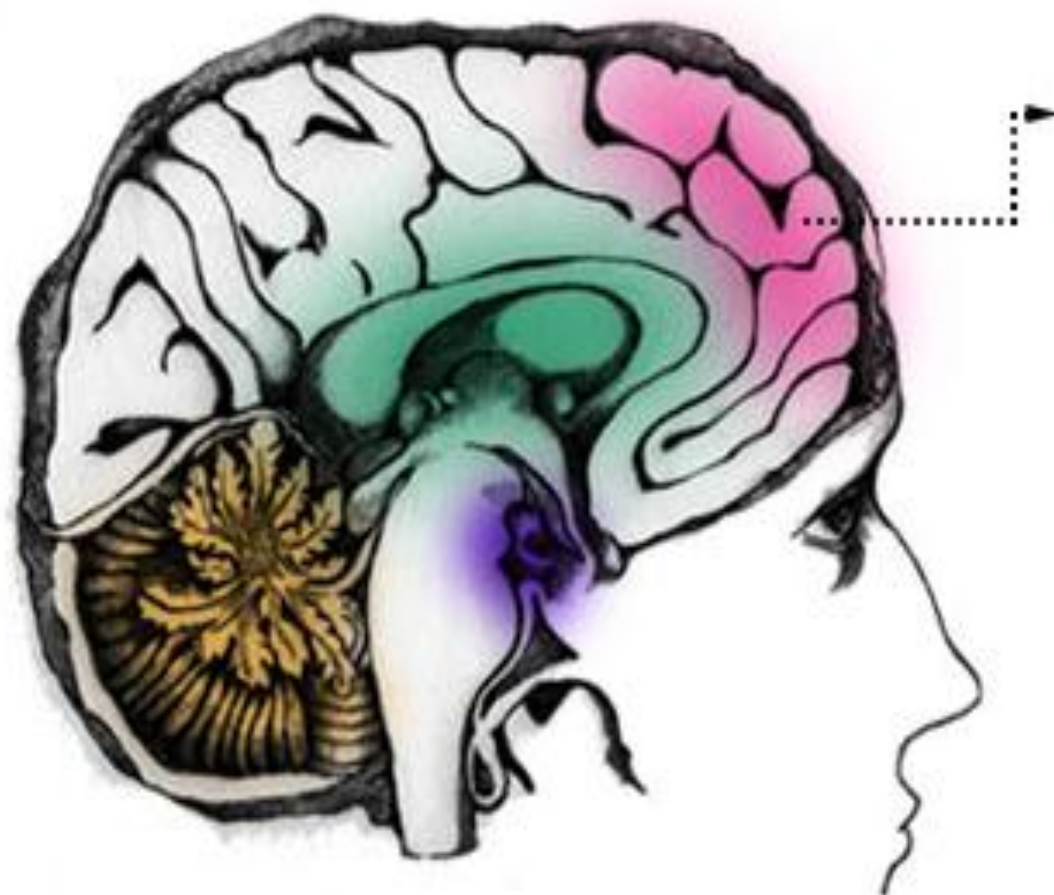


Corpus Callosum

This is a cable of nerves that connects the two hemispheres of the brain, and is believed to be involved in creativity and problem solving. It appears to change and grow significantly through adolescence.

Anatomy of a Teen Brain

Roll over a part of the brain for more information.



Frontal Cortex

The frontal cortex is often referred to as the "CEO" of the brain, because it is the part responsible for planning, strategizing, and judgment. Recent research has shown that this area undergoes a growth spurt at around the ages of 11-12, followed by a period of pruning and organizing of the new neural connections during the teen years.

THIS IS YOUR BRAIN ON ADOLESCENCE!

BRAIN DEVELOPMENT SUMMARY

- ▶ *The largest re-organization of the brain takes place at approximately two time frames:*
 - ▶ *In the early years from 0-4 years.*
 - ▶ *In the adolescent years from 9-12.*
- ▶ *The brain is not fully “installed” until age twenty and is developing during the teen years.*
 - ▶ *Ages 9-10 the frontal lobes undergo a second wave or re-organization forming millions of new synapses that process information.*
 - ▶ *Ages 11-12 a massive pruning gets rid of unused pathways allowing the brain to function more efficiently.*
 - ▶ *This process continues into the late teens.*

THIS IS YOUR BRAIN ON ADOLESCENCE!

INTELLECTUAL AND PHYSICAL DEVELOPMENT

► *Intellectual:*

- *Moving to abstract thought.*
- *Are intensely curious.*
- *Prefer active learning experiences.*
- *Favor interaction with peers during learning activities.*
- *Enjoy using skills to solve real life problems.*
- *Are egocentric, argue to convince others, exhibit independent, critical thought.*
- *Consider academic goals as a secondary level of priority, personal-social concerns dominate thoughts and activities.*

► *Physical Development:*

- *Accelerated physical development:*
- *Mature at varying rates of speed:*
- *Experience bone growth faster than muscle development:*
- *Wide range of individual differences appear in pre-pubertal and pubertal stages of development. Age 13*
- *Experience biological development five years sooner than adolescents in the last century.*
- *Disturbed by body changes.*
- *Metabolism causes restlessness, listlessness and effects eating habits.*

THIS IS YOUR BRAIN ON ADOLESCENCE! INTELLECTUAL AND PHYSICAL SUMMARY

► *Intellectual/Physical:*

- *Are intellectually at risk, face decisions that have the potential to affect major academic values with lifelong consequences.*
- *Face responsibility for sexual behavior before full emotional and social maturity has occurred.*
- *Overtax digestive systems with large quantities of improper foods.*
- *Poor levels of endurance, strength and flexibility.*
- *Fatter, unhealthier and more physically at risk.*
- *Leading causes of death: Homicide, suicide, accidents.*

THIS IS YOUR BRAIN ON ADOLESCENCE!

PSYCHOLOGICAL AND SOCIAL DEVELOPMENT

► *Psychological:*

- Erratic and inconsistent in behavior.
- Anxiety and fear are contrasted with bravado. Superiority to inferiority.
- Chemical and hormonal imbalances trigger emotions that can cause regression to childish behavior patterns.
- Easily offended and sensitive to criticism of personal shortcomings.
- Exaggerate simple occurrences and believe personal problems, experiences and feelings are unique to themselves.
- Moody, restless, self-conscious and alienated, lack self-esteem and introspective.

► *Social:*

- Conflicts with loyalties to peer groups and family.
- Peers are source for standards and models of behavior as well as heroes.
- Rebellious toward parents but still dependent on parental values.
- Want to make their own choices but authority of family is critical factor in decisions.
- Act out unusual or drastic behavior at times, aggressive, daring boisterous and argumentative.
- Fiercely loyal to peer group values and are sometimes cruel or insensitive to those outside their peer groups.
- Challenge authority figures, test limits of acceptable behavior.

THIS IS YOUR BRAIN ON ADOLESCENCE PSYCHOLOGICAL AND SOCIAL SUMMARY

► *Psychological/Social:*

- Searching for answer to “Who Am I?”
- Psychologically at risk, at no other point in human development is an individual likely to encounter so much diversity in relation to oneself and others.
- Socially at risk, adult values are largely shaped conceptually during adolescence, negative interactions with peers, parents and teachers may compromise ideals and commitments.

**THIS IS YOUR BRAIN ON TECHNOLOGY:
INTRODUCING THE “IGENERATION:**

***As if that brain isn't
broken enough. The new
re-wiring catalyst....
TECHNOLOGY***

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Understanding the Generations:

- **Baby Boomers-**
 - Born between 1946-1964.
 - First of this generation just hitting retirement age.
- **Generation X-**
 - Born between 1965-1970s.
 - Most of the teaching workforce.

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Understanding the Generations:

- **Net Generation-**
 - Born between 1980 and mid 1990s.
 - New teachers @ 1987-1988.
 - High school students @-1993-1997.
- **iGeneration-**
 - Born late 1990s through 2008.
 - Entering school to early middle school age.

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “iGENERATION”

The “iGeneration” Defined:

- Children born in the late 1990s and early part of the new millennium.

Named for two key factors

- Presence of “i” in so many of the devices they love.
- Expectations for “i” to mean individualized.

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”



Type	Home computer
Release date	August 1982 ²¹
Discontinued	April 1994
Operating system	Commodore KERNAL/ Commodore BASIC 2.0 GEOS
CPU	MOS Technology 6510 @ 1.023 MHz (NTSC version) @ 0.985 MHz (PAL version)
Memory	64 kB RAM + 20 kB ROM
Graphics	VIC-II (320 × 200, 16 colors, sprites, raster interrupt)
Sound	SID 6581 (3× Osc, 4× Wave, Filter, ADSR, Ring)
Connectivity	2× CIA 6526 Joystick, Power, Cartridge, RF, A/V, IEEE-488 Floppy/Printer, Digital tape, GPIO/RS-232
Predecessor	Commodore VIC-20
Successor	Commodore 128

Understanding Their World:

- Kilobyte=@1000 B.
- Megabyte=@1000 KB.
- Gigabyte=@1000 MB.



Lady Gaga-Bad Romance.

- 6.85 MB.
- 6850 KB.
- 108 Commodore 64s to play the song.

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Understanding Their World:

- **Have never known life without:**
 - **Wireless high speed internet**
 - **Cell phone with 3G data connection**
 - **Texting**
 - **Gaming Consoles**
 - **iPods and/or MP3 players**

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Understanding Their World:

- **Since Their Birth:**
 - iPod, iPhone, iPad.
 - Wii, Xbox, PlayStation.
 - Facebook, MySpace, Twitter.
 - Google, Wikipedia, Android.
 - Flash Drive, Travel Drive.
 - Satellite Radio, Pandora, YouTube, Streaming video.

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

*Technology Use among School Aged Children and Adolescents**

Technology Type (Hours of Use)	Age Group			
	4-8 years	9-12 year	13-15 years	16-18 years
Internet	0:27	0:59	1:58	2:24
Computer Use (non-web)	0:23	0:57	1:44	1:59
E-Mail	0:06	0:26	1:08	1:19
IM/Chat	0:05	0:28	1:24	2:16
Telephone	0:17	0:43	1:07	1:50
Texting	0:07	0:46	2:19	3:32
Video Games	1:32	2:07	1:20	1:17
Television	1:56	1:56	1:58	2:10
Music	0:42	1:24	2:49	3:33
Overall (All Media)	5:35	9:46	15:47	20:20

Mears, D. (in Press) Welcome to the “iGeneration”: Implications of children’s technology usage on physical education and childhood obesity. In S. Sanders & L. Hansen (Eds.) *Educational policy in the 21st century opportunities, challenges, and solutions: Reflections on making the case for contemporary use of technology in teaching physical education: Promoting physical activity and fighting childhood obesity.* (pp. xx-xx) Charlotte, NC: Information Age.

Rosen, L. D. (2010). *Rewired: Understanding the “iGeneration” and the way they learn.* New York: St. Martin’s Press

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Multi-Tasking Comparisons among Generations

Type of Technology	Net Generation & iGeneration (1980-Current)	Generation X (1965-1971)	Baby Boomers (1946-1964)
Playing Video Games	57%	49%	42%
Reading	58%	52%	43%
Face to Face Conversation	73%	70%	65%
Computer Use (Off line)	75%	67%	56%
Television Viewing	77%	71%	64%
E-Mail	78%	69%	58%
Texting	79%	65%	51%
Phone Conversations	78%	73%	65%
Internet Use	79%	73%	62%
Listening to Music	88%	82%	75%

Mears, D. (in Press) Welcome to the “iGeneration”: Implications of children’s technology usage on physical education and childhood obesity. In S. Sanders & L. Hansen (Eds.) *Educational policy in the 21st century opportunities, challenges, and solutions: Reflections on making the case for contemporary use of technology in teaching physical education: Promoting physical activity and fighting childhood obesity.* (pp. xx-xx) Charlotte, NC: Information Age.

Rosen, L. D. (2010). *Rewired: Understanding the “iGeneration” and the way they learn.* New York: St. Martin's Press

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Home Technology Availability of School Aged Children and Adolescents

Type of Device*	Age Group			
	4-8 years	9-12 years	13-15 years	16-18 years
Television in Bedroom	62%	67%	68%	73%
Computer in Bedroom	10%	24%	34%	43%
Personal Cell Phone	10%	51%	81%	92%
Personal iPod/MP3 Player	26%	66%	85%	87%
Video Game Console	54%	74%	70%	56%
Hand Held Video Game Player	53%	68%	54%	31%
<hr/>				
Three or More Devices**	8-10 years	11-14 years	15-18 years	
Televisions	67%	76%	74%	
Digital Video Recorders	42%	57%	58%	
Video Game Consoles	30%	35%	28%	
Computers	10%	14%	20%	
Internet Access	63%	78%	80%	
Instant Messaging	42%	63%	70%	

Mears, D. (in Press) *Welcome to the “iGeneration”: Implications of children’s technology usage on physical education and childhood obesity*. In S. Sanders & L. Hansen (Eds.) *Educational policy in the 21st century opportunities, challenges, and solutions: Reflections on making the case for contemporary use of technology in teaching physical education: Promoting physical activity and fighting childhood obesity*. (pp. xx-xx) Charlotte, NC: Information Age.

Roberts, D. F., Foehner, U. G., & Rideout, V. (2005). *Generation M: Media in the lives of 8-18 year olds*. Retrieved from <http://www.kff.org/entmedia/entmedia030905pkg.cfm>

Rosen, L. D. (2010). *Rewired: Understanding the “iGeneration” and the way they learn*. New York: St. Martin's Press

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Screen Time, Physical Education and Childhood Obesity Levels

Criterion	Year			
	2003	2005	2007	2009
Watched Television 3 or more hours daily	38.2%	37.2%	35.4%	32.8%
Used Computers 3 or more hours daily	22.1%	21.1%	24.9%	24.9%
Percentage of Adolescents Overweight	14.8%	15.7%	15.8%	15.8%
Percentage of Adolescents Obese	12.1%	13.1%	13.0%	12.0%
Did not Meet Physical Activity Guidelines*	N/A	64.2%	65.3%	63.0%
No Physical Activity During the Week	N/A	25.0%	24.9%	23.1%
No Physical Education Attendance	44.3%	45.8%	46.4%	43.6%
No Physical Education Daily	71.6%	67.0%	69.7%	66.7%

Note *Defined as 60 minutes 5 days per week. Data from high school aged children and adolescents grades 9-12 (U.S. Department of Health and Human Services & Centers for Disease Control and Prevention, 2011).

U.S. Department of Health and Human Services, & Centers for Disease Control and Prevention. (2011). Trends in the Prevalence of Obesity, Dietary Behaviors and Weight Control Practices National YRBS: 1991-2009. Washington, D.C.: Author.

Mears, D. (in Press) Welcome to the “iGeneration”: Implications of children’s technology usage on physical education and childhood obesity. In S. Sanders & L. Hansen (Eds.) Educational policy in the 21st century opportunities, challenges, and solutions: Reflections on making the case for contemporary use of technology in teaching physical education: Promoting physical activity and fighting childhood obesity.(pp. xx-xx) Charlotte, NC: Information Age.

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Teaching and Learning Characteristics:

- They were introduced to technology at birth and have always known a world containing constant bombardment of media and technology.
- Many of the types of technology considered by their teachers as “innovations” have been commonplace their entire lives.
- Their teachers and school systems reasons may be slower to incorporate new technologies into their instruction.
- They may require constant motivation and reinforcement for task completion and have a tendency want immediate answers versus having to process or conduct extensive searches for information.

Mears, D. (in Press) Welcome to the “iGeneration”: Implications of children’s technology usage on physical education and childhood obesity. In S. Sanders & L. Hansen (Eds.) *Educational policy in the 21st century opportunities, challenges, and solutions: Reflections on making the case for contemporary use of technology in teaching physical education: Promoting physical activity and fighting childhood obesity*. (pp. xx-xx) Charlotte, NC: Information Age.

Rosen, L. D. (2010). *Rewired: Understanding the “iGeneration” and the way they learn*. New York: St. Martin's Press

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Teaching and Learning Characteristics:

- They crave to a near obsession involvement in the social worlds created by Facebook, MySpace and Twitter as well as internet based information.
 - Cellular Phones 12-14 years for 50 million users.
 - YouTube less than one year.
 - Because of this social networking they may have an inability to separate individual from collaborative or do not see plagiarism or trading assignments or information as cheating.

Mears, D. (in Press) Welcome to the “iGeneration”: Implications of children’s technology usage on physical education and childhood obesity. In S. Sanders & L. Hansen (Eds.) *Educational policy in the 21st century opportunities, challenges, and solutions: Reflections on making the case for contemporary use of technology in teaching physical education: Promoting physical activity and fighting childhood obesity.* (pp. xx-xx) Charlotte, NC: Information Age.

Rosen, L. D. (2010). *Rewired: Understanding the “iGeneration” and the way they learn.* New York: St. Martin's Press

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Teaching and Learning Characteristics:

- They tend to be close to family, and parents tend to be very involved in their children's education.
- Parents are of the “Net Generation” and are themselves technology driven and maintain a high degree of parental involvement.
- Parents want web-based access to teacher grade books through programs such as Zangle™ or Skyward™.

Mears, D. (in Press) Welcome to the “iGeneration”: Implications of children's technology usage on physical education and childhood obesity. In S. Sanders & L. Hansen (Eds.) *Educational policy in the 21st century opportunities, challenges, and solutions: Reflections on making the case for contemporary use of technology in teaching physical education: Promoting physical activity and fighting childhood obesity*. (pp. xx-xx) Charlotte, NC: Information Age.

Rosen, L. D. (2010). *Rewired: Understanding the “iGeneration” and the way they learn*. New York: St. Martin's Press

THIS IS YOUR BRAIN ON TECHNOLOGY: INTRODUCING THE “IGENERATION”

Teaching and Learning Characteristics:

They are advanced multi-taskers and welcome and embrace any new type of technology that comes along.

Table 4.1 How Do Generations Differ in Multitasking?

Activity	Likelihood of Multitasking with Other Tasks		
	Net Gen & iGen	Gen X	Baby Boomer
Playing Video Games	57%	49%	42%
Reading Books and Magazines	58%	52%	43%
Talking Face to Face	73%	70%	65%
Working on the Computer But Not Online	75%	67%	56%
Watching TV	77%	71%	64%
E-Mailing	78%	69%	58%
Texting	79%	65%	51%
IMing	78%	61%	51%
Talking on the Telephone	78%	73%	65%
Surfing the Web	79%	73%	62%
Listening to Music	88%	82%	75%

HOW DO I MANAGE THIS WITHOUT BREAKING MY BRAIN!

