Educating Students Who Have Different Kinds of Minds

Temple Grandin

Colorado State University
• What would happen to top Innovators in today’s educational system?
• Many of them had an unconventional educational path to a successful career
Jane Goodall

- Had a two-year secretarial degree
- Obtained her Ph.D. without a Bachelor’s Degree
- Difficulty remembering faces
Thomas Edison

- Labeled addled by a teacher
- Hyperactive
- High School drop out
Stephen Spielberg

- Rejected from a top film school due to poor grades
- Bullied in school
- Dyslexic
Elon Musk

- Mother said “Elon was always a little different in a nerdy way.”
- Severe bullying in middle and high school
- Appeared deaf

Credit: Ashlee Vance, 2015
Dragon Docks with Space Station

Credit: NASA
Common Denominators of Success for Unique Minds

- Grew up in an educated family
- Early exposure to career interests with hands-on projects
- Learned to work hard at an early age
- Not overspecialized
- Mentors to help start career path
Jane Goodall

- “First serious observation of animals” was watching hens lay eggs when she was five
- Loved solitude in trees

Credit: Treats 4 Chickens
Jane Goodall

- Talented high school student raised in a home with many books
- Favorite books – *Dr. Doolittle, Jungle Book*, and *Tarzan*
- Mentor – Dr. Leakey
Thomas Edison

- Childhood chemistry experiments and exposed to railroads, grain elevators, and ships
- Home schooled by highly educated mother in house full of books
Thomas Edison Early Teenage Work Experience

- Newsboy and started own paper
- Telegraph operator

Credit: Thomas Edison Depot Museum
“His questions were so ceaseless and innumerable and the penetrating curiosity of an usually strong mind was regarded as a deficiency in comprehension.”

Credit: Frank L. Dyer and Thomas C. Mailem
Stephen Spielberg

- Made movies as a child on a Super 8
- Received an internship at Universal Studios
- “Movies saved me from shame”

Credit: attitudemag.com
Elon Musk Dreamed of Space

Compulsive reader – Local bookstore let him read
Elon Musk Childhood

- Learned skilled trades on his father’s engineering projects
- Extensive international travel
- Age 11 received a Commodore Computer and learned programming
- Homemade rockets
Hard Worker

• As a teenager tried to lease a shop for video arcade
  ▪ Early 20’s did grubby manual labor
  ▪ Internship at Bank of Nova Scotia helped him create PayPal
  ▪ Completed college
Used Car Wash Valves with Different Seals

Built rocket at a lower price
Research on Creative Genius

- Did not complete a conventional educational path

Credit: Dean Simonton, Creativity in Science, Logic Genius and Zeitgeist

- Did not overspecialize

Credit: Eric Weaver, Geography of Genus
Three Different Types of Thinking

1. Photo Realistic Visual Thinking **Object Visualizer** – Poor at algebra

2. Pattern Thinker **Spatial Visualizer** Music and Math – Poor in reading

3. Verbal Facts **Language Translation** – Poor at drawing

4. Auditory Thinker – Visual perception fragmented

There can be mixtures of these thinking types
Visual Thinkers are Associative Thinkers

- Mind works like Google Images
- Keywords trigger visual associations
- Book: The Autistic Brain contains scientific references
Insights into Musk’s Thought Processes

• He could see images in his mind
• “The part (of the brain) that is used for processing visual images coming from my eyes gets taken over by internal thought processes”

Credit: Ashlee Vance, 2015
Musk could read and process vast amounts of information from different fields
Thomas Edison

- Not a mathematician
- “I can always hire some mathematicians but they can’t hire me.”

Credit: Frank L. Dyer and Thomas C. Mailem, 2010
• Overspecialization may hinder creative problem solving

• A top researcher reports that highly specialized graduate students lack creativity
Medicine Good Example of Overspecialization

- Lupus specialist does hive biopsies
- A bone specialist fails to test for infectious reasons for a patient’s symptoms
“A degree is the first step down a ruinous highway. You don’t want to waste it so you go onto doctoral research. You end up a thorough ignoramus on everything in the world except for one subdivisional sliver of nothing.”

Credit: Isaac Asimov
Artificial Intelligence can do the super specialized tasks. It cannot do tasks that require more generalized knowledge.
AI expert system reads x-rays better than doctors but cannot do an executive assistant job

Credit: The Economist, June 25, 2016
• Visual thinkers, AI, and people with autism are all bottom up thinkers.

• Concepts are formed from specific examples

• Top down visual thinkers tend to overgeneralize
• What would happen to a child like me today??
• No speech until age four
• Symptoms of severe autism
- Would receive excellent early education to develop speech
- Prime candidate for video game addiction
- Less opportunities for hands-on learning and developing art skills
- Less opportunities to get work experience as a teenager
Brain Scans of Large Visual Thinking Circuit

Control

T. Grandin

Humphreys, Minshew, Behrmann, and Cibu, 2006
Brain Scans

T. Grandin  
Control

Humphreys, Minshew, Behrmann, and Cibu, 2006
Abnormalities in Left Hemisphere

Working Memory and Algebra Department Failed to Develop

University of Utah, 2010
• No academic barrier to entry in the livestock and meat industry
• In 1967, algebra was not the required math class for college
• Took finite math, statistics, and probability
• Entered college on probation and graduated second in my class
My Childhood Educational Journey

• Educated family – Books important in my life
• Art ability was nurtured
• Made kites and helicopters with cardboard and paper
• Mother read to me and taught me reading
Favorite Books

- Book about famous inventors
- *Wizard of Oz*
- *Black Beauty*
Early Exposure to Career Interest in High School

- Rode horses
- Worked with cattle
- Learned carpentry
- Experimental psychology class
- Poor student except in biology and writing
Early Development of Work Ethic in High School

- Sewing job at 13
- Horse stall cleaning at 15
- Roofing at 16
- Sign painting
- Carpentry work
Not Overspecialized

• Favorite college classes – Animal Behavior, Biology, Experimental Psychology, English Literature
• Practical building skills in carpentry
High School Mentors

• Science teacher motivated me to study to achieve goal of becoming a scientist

• Aunt Ann on the ranch
  ➢ Built gates
  ➢ Learned driving
  ➢ Learned to type
Since I was weird, I learned how to impress potential customers by showing a portfolio of my work.
People Were Impressed With My Drawings
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USDA survey prior to industry wide auditing

McDonald’s Audits started

Continued auditing by major customers

Continuous auditing maintains good performance
Different Kinds of Minds Complement Each Other in Meat Industry

• Visual thinkers in Drafting Department – Design whole plant layout

• Millwrights – Welders invent new mechanical equipment

• Engineers with formal degrees do – boilers, refrigeration, calculate roof trusses
Is observation part of real science?
I say yes
Astronomy, epidemiology (starts with anecdotal reports)
When I learned how my visual thinking was different from verbal thinking, it gave me insight into how different people’s brains approach problem solving
IPhone

- Steve Jobs – Artistic Visual Thinker
  Designed the easy-to-use interface
- Engineers had to make it work
- The two types of minds were required to make a really good phone
• Educators must not screen out students with unique skills
• The World Needs All Kinds of Minds