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ED STEM Resources

- STEM Webpage  www.ed.gov/STEM
- STEM Newsletter  www.ed.gov/subscriptions
- Next STEM Webinars:
  - Summer STEM Learning, early May
  - Advanced Manufacturing, June
- Ready Now Special Ed Technologies
- Special Ed Technologies Webinar/Recap
• SWD score lower on NAEP
• SWD = 12% of HS population but less than 1% in AP courses
• Fewer SWD graduate HS
• ~20% undergrads report a disability, often older
• 28% of undergrad SWD in S&E fields, on par
• SWD leave college w/o degree at higher rates
• S&E w/ disability more likely to be unemployed
Larry Wexler

Director, Research to Practice Division, Office of Special Education Programs, U.S. Department of Education
OSEP Resources Related to Autism

- IDEA requires every child with a disability be provided a free appropriate public education (FAPE). FAPE services are provided based on needs rather than based on a disability label.

- Intensive Intervention: Interventions for students with disabilities, many of whom have autism, who have severe and persistent learning or behavior difficulties who require intensive specialized instruction to succeed in school and be prepared for postsecondary opportunities.
OSEP Resources Related to Autism

- OSEP funds grants to support children with disabilities with the most intensive needs: Includes children with autism
  - Personnel Preparation Grants: Some focused on autism content.
  - Funded TIES Center to provide Technical assistance to States & Districts to support children with the most significant cognitive disabilities in the general education environment.
  - Funded AFFIRM autism professional development training modules: 200,000 new users during pandemic.
  - IRIS: Autism training modules, Assistive technology training modules.
  - Data: Published autism longitudinal data to drive discussion: OSEP Fast Facts: Children Identified With Autism.
Joyce Ward

Director, Office of Education, U.S. Patent and Trademark Office

National Council for Expanding American Innovation
https://www.uspto.gov/kids/Cards-Temple.html
https://www.uspto.gov/kids/activities.html
https://www.uspto.gov/kids/parents.html
Student Programs
Dr. Temple Grandin

Professor, Animal Science, Colorado State University

Inventor

Autism Advocate
The World Needs All the Different Kinds of Minds

Temple Grandin, Professor of Animal Science

Colorado State University
These Innovators Had Creative Hobbies

- Bullied in school
- Learned calligraphy

- No speech until age 3
- Played the violin
Thomas Edison

- Labeled addled by a teacher
- Hyperactive High School drop out
- Probably had autism
Jane Goodall

- Had a two-year secretarial degree
- Obtained her Ph.D. without a Bachelor’s Degree
- Difficulty remembering faces
- Loved solitude in the trees
Stephen Spielberg

- Rejected from a top film school due to poor grades
- Bullied in school
- Dyslexic
- Childhood Super 8 Movie Camera
Four Different Types of Thinking

1. Photo Realistic Visual Thinking Object Visualizer – Poor at algebra
2. Pattern Thinker Visual Spatial 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
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
How to Determine Types of Thinkers in Children

- **Visual Thinker** – Art, building things, and mechanical ability
- **Math Thinker** – Mathematics, building things, computer programming, music
- **Verbal Thinker** – Love facts, history
Grandfather Co-Invents Auto Pilot

Different Kinds of Minds Complemented Each Other

- Visual Thinker
- Mathematical Engineer
Schools Need to Keep Classes that Foster Creativity and Problem Solving

- Art, sewing, cooking
- Playing musical instruments
- Woodworking
- Theater
- Welding
- Auto Shop
- Creative writing
Arts Foster Scientific Success

- Nobel prize winners 50% more likely to have an arts and craft hobby compared to other scientists
- Painter, musician, actor, dancer, composer, poet, photographer or craftsman

Robert Root Bernstein et al., 2008
Since I was weird, I learned how to impress potential customers by showing a portfolio of my work.
Sold my work by showing my portfolio
People Need to Touch in Order to Perceive
Picture From My Original Portfolio
Replica Used in HBO Movie *Temple Grandin*
LIVESTOCK HANDLING SYSTEMS
A Well Designed Facility will help make your Livestock Operation More Profitable.

CUSTOM DESIGNED To Fit Your Operation:
Working, sorting, loading and hospital facility at A. Glen Klise Feedlot in Redmond, Nebraska. The system has a curved level loading chute, herding depression, sorting pens, scale, covered hospital pens, working circle and horse pens. Curved chutes and smooth traffic flow reduce stress and improve efficiency. The covered working circle is designed for easy washdowns. Employers will do a better job of processing in clean facilities which protect them from the weather. Careful gentle processing will improve cattle performance.

CURVED WORKING CHUTES For Greater Efficiency:
A curved single file chute, round crowding pens and wide curved alleys are labor saving and reduce stress at Alan Vorster's cow calf operation in Saskatchewan, Canada. A handler working from the crowding along the inner radius can move cattle easily into the round crowd pens and squeeze. Cattle can be sorted 3 ways after the squeeze chute. Grandin designs handling facilities for all types of ranch and feedlot operations.

GRANDIN LIVESTOCK HANDLING SYSTEMS, INC.
Suite 1, 1401 Silver St.
Urbana, IL 61801  217-384-4815

Put it on your phone
30 Second WOW
Half the Cattle in North America are Handled in Systems I Designed
Aerial Photo of Early Major Project
First Dip Vat Project - 1976
Worried our educational system is screening out visual thinkers with strict algebra requirements

Visual Thinkers needed to prevent serious problems such as Fukushima reactor meltdown and aviation accidents
Mathematicians Calculate Risk

Visual Thinkers See Both Risk and Solutions to Problems

Possible Impact with Terrain
A Visual Thinker Would See Ways the Small Fragile Sensor Could Break
We Have Lost the Skills to Build This
Who Builds Large Food Processing Plants?

- **Visual thinkers** – Design plant layout and build highly specialized mechanical equipment
- **Math Thinkers** – Engineers, boilers, refrigeration, calculate roof trusses
- **Retiring Visual Thinkers** - Not getting replaced
 Visual thinkers, AI, and some people with autism, ADHD or dyslexia are all bottom up thinkers.

 Concepts are formed from specific examples

 Top down verbal thinkers tend to overgeneralize

 Sensory Based *not* Word Based notices detail
Tips for Working with Minds That are Different

- Never overload working memory
- Provide Pilot’s Checklist for tasks with multiple steps
- Stretch them slightly out of their comfort zones
- Limit screen time
- Provide choices of hands-on activities
Ultimate Goal of Education

- Where is a student ten years after high school graduation?
- Learn to be a life-long learner
Dr. Megan Vinh

Co-Director, STEM Innovation for Inclusion in Early Education Center (STEMIE) and the Early Childhood Technical Assistance Center
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STEMIEFest archives available at https://stemie.fpg.unc.edu/stemiefest
Cary Supalo

Research Developer,
Educational Testing Service
My life changed at age 7...

I had a normal day, went to bed, then woke up blind…
“...you have been problem-solving your whole life...”

Dr. Mallouk, Penn State
do education research
Bodner Group (2014 – 2018)

break barriers
assistant professor of chemistry
(2012 – 2014)

innovate Access Technology
for teaching STEM
Founder (2009)
President (2009 – 2016)

Accessible assessment systems for education
Research Developer (2016-curr.)
Full integration into education needs access to learning tools, resources, assessments, and mentorship.
We can move the needle on access and inclusion in quality education by shifting the assessment lever.
<table>
<thead>
<tr>
<th>Born-Accessible Inclusive Test Item Design: Some Research Areas</th>
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<tbody>
<tr>
<td>Leveraging commercially available access technologies with appropriate braille and raised line drawing supplements.</td>
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<tr>
<td>Multi-modal interfaces to access math and science assessments</td>
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<tr>
<td>Efficacy of computer-based inclusively designed science simulations</td>
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Removing Access Barriers in STEM: Some Research Areas

- Efficaciously delivered real-time electronic math and science content.

- Non-ambiguous teaching methodologies to shift vision-normative STEM instruction.

- Shifting STEM teachers’ expectations of the capabilities of the blind in K12+HE contexts.

- Developing next generation science access tools.
Inclusion is increasingly a trend in spaces where it was once thought impossible. Live the life you want!
Allyson Knox

Education Policy Lead,
Microsoft Philanthropies

Microsoft Neurodiversity Hiring
Commitment to Diversity
Code.org Accessibility
Resources

- National Center for Special Education Research (incl. STEM)
- Compendium of Math & Science Research by NCES & NCSER (2002-2013)
- OSEP Fast Facts: Children Identified With Autism
- Ready Now Special Ed Technologies
- IES Special Ed Technologies Webinar/Recap
- Zero Barriers in STEM Education
- INCUDES Network
- Disabilities, Opportunities, Internetworking and Technology (DO-IT)
- Research in Disabilities Education Collaborative Dissemination
- STEMIE
- STEM for All Multiplex: Including Individuals with Disabilities in STEM
- PhET Interactive Simulations