Twice-Exceptional Learners with Spatial Strengths: Strategies for Strength-based Instruction

Rebecca L. Mann
Co-Director of GERI
rlmann@purdue.edu

Einstein

da Vinci

Edison

www.purdue.edu/geri look under Professional Development

What is a Learning Disability?

It is a neurological/physiological difference in the way the brain is organized.

A neurological disorder that effects the brain's ability to receive, process, store and respond to information…
At least average intelligence…
Difficulty in acquiring basic academic skills…

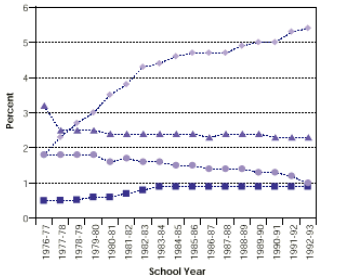
(National Center for Learning Disabilities)

What is Spatial Ability?

Spatial ability …

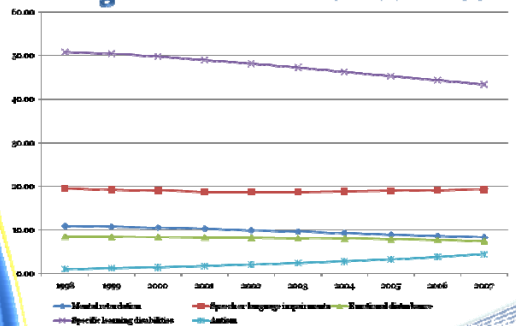
- ability to comprehend relationships between fluid, changing patterns (Dixon, 1983)
- ability to manipulate complex visual material (Shea, Lubinski, & Benbow, 2001)
- a dimension of cognition that combines with verbal and quantitative abilities to define how an individual perceives the world and acquires new knowledge (Gardner, 1993; Shea et al.)

Percentage of Children Identified as Manifesting the Most Common Disabilities in the Years 1977 through 1993



Source: Office of Special Education Programs, Implementation of the Individuals with Disabilities Education Act: Fifteenth Annual Report to Congress, Washington, DC: U.S. Department of Education, 1993

Percentage of children served 1998- 2007



Characteristics of Twice Exceptional Learners

Signs of Giftedness	Signs of Learning Disabilities
~excellent long-term memory	~poor short-term memory
~extensive vocabulary	~oral vocab more sophisticated than written
~ excels in reading comprehension	~struggles with decoding words
~excels in mathematical reasoning	~does poorly at computation
~advanced verbal skills in discussions	~refuses to do written work
~facile with computers	~handwriting is illegible
~grasps abstract concepts	~has difficulty with spelling and phonics
~performs better with challenging work	~struggles with easy, sequential material
~thrives on complexity	~difficulty with rote memorization

Signs of Giftedness	Signs of Learning Disabilities
~highly creative, imaginative	~often inattentive in class
~reasons well	~emotions can overpower reasoning
~is a keen observer	~poor auditory memory
~may have acute hearing	~poor listening skills
~has very interesting ideas, extremely curious	~weak in language mechanics
~high degree of energy	~may be unable to learn unless interested
~perceptive	~performs poorly on timed tests
~insightful (seems "wise")	~hopelessly disorganized
~excellent sense of humor	~finds clever ways to avoid weak areas
~may excel at art, science, geometry, mechanics, technology, or music	~may fail at foreign languages and subjects emphasizing audition, sequencing, memory

(Silverman)

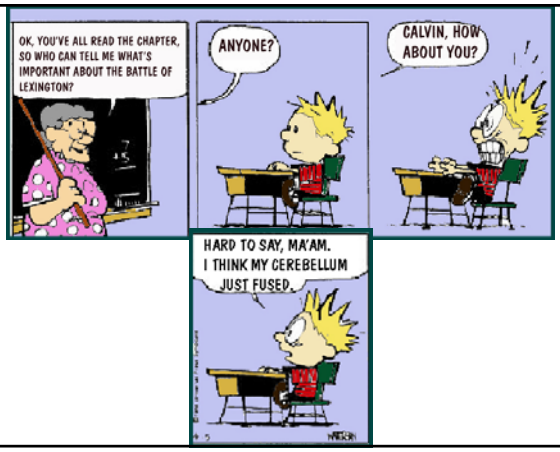
Strengths vs. Deficiencies

Strengths	*Deficiencies*
Thinking Abilities	*Self Expression*
High Creativity	*Organizational Abilities*
Long-term Memory	*Short-term Memory*
Abstractions	*Sense Perceptions (distractibility, static on the auditory channel, sensori-motor)*
Problem Solving	*Social Interactions*
Insight	*Self-esteem*

(Coleman, 1996)

Organizational Difficulties can be:

Thoughts going in
Thoughts coming out
Stuff
Time



Why Nurture Spatial Skills?

Schools emphasize verbal, not spatial skills

Traditional assessments (SAT, GRE) do not assess spatial skills (Gohm, Humphreys, and Yao)

Undergraduate majors in 2000:

- **Only 5.6 majored in engineering**
- **A mere 0.8 majored in mathematics**

Doctorates earned in U.S. by non-citizens?

- **Engineering = 51%**
- **Mathematics = 43%** (NSF)

Individuals gifted in spatial ability undereducated and underemployed (Gohm, 1998)

Increasingly technological world needs ability to comprehend complex relationships and problem solvers with unique strategies (Shea, Lubinski, Benbow, 2001)

Selecting top 3% based on verbal or mathematical ability results in loss of more than half of students representing top 1% of spatial ability (Shea, Lubinski, & Benbow)

POSSIBLE SPATIAL CAREERS

- Land Surveyor
- Geo-spatial Technician
- Satellite Operations
- Surgeon
- Cartographer
- GIS (Geographic Information Systems)
- Computer Programmer

- Engineer
  - Electrical
  - Mechanical
  - Aeronautical
  - Environmental
  - Materials
- Physicist
- Chemist
- Geophysicist
- Architect
- Inventor

WHO ARE THESE CHILDREN?

- Lego maniacs – the builders
- Problem finders
- Creative problem solvers
- Puzzle and maze doers
- Technological geniuses

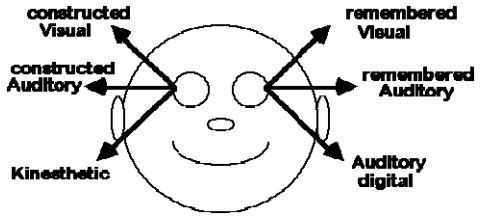
None of my toys work because I took them all apart to see what makes them work.

HOW DO THEY LEARN?

- Visualization
- Whole to part
- The why…then the how
- Difficult is easy
- Aha!
- Intuition
- Discovery
- On the job

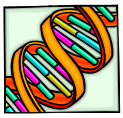
Visualization

NLP: Neuro-Linguistic Programming



Visualize words - spell forwards and backwards
Visualize concept - how the system works
Flashcards with answers

VISUALIZE



Show everything - use overhead or white board, color is better than chalkboard

Encourage the child to visualize lists, patterns, situations

Ask the child if he can make a picture of what the topic represents

Ask yourself, "How would I teach this concept to a deaf child?"

Whole to Part

- Often perceived as "slow processors"
- Perceive relationships between the parts and the whole
- Don't understand if learning is doled out in small chunks
- Can't grasp isolated facts until the big picture is in view
- Have difficulty attending to details
- Real life and multidisciplinary approaches effective

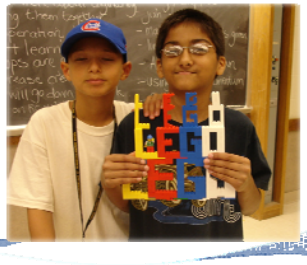
The Why…then the How

Reflective: They need extra thinking time therefore, they can appear to be lazy or to be daydreaming.

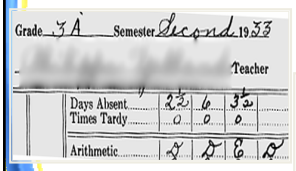
Difficult is Easy

Concepts vs. computation

Detest routine, repetitive tasks and does not learn by rote memorization

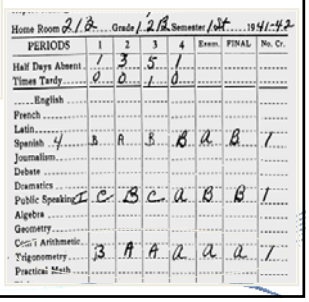


Report cards of a highly visual spatial learner



Computation - Third Grade Math

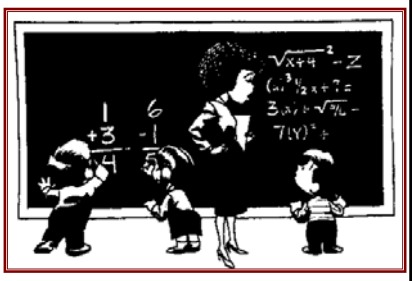
Concepts - Trigonometry



Increase the Difficulty

Do not force the student to succeed at easier material before trying the difficult work.

Emphasize mastery of higher level concepts instead of perfection of simpler concepts.



How many times do I have to tell you... you're not supposed to read ahead.

Mathematics

- Give chance to devise own method of problem solving
- Avoid drill and repetition - No timed tests
- Do five hardest problems and go on if successful
- Look for patterns in multiplication charts

  5678 56=7x8 4x9=6x6
- Teach within the context of entire number system
- Division - give divisor, dividend & quotient then let child figure out the system
- Look for patterns within math
- Make it meaningful

PATTERNS IN MULTIPLICATION

x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

AHA!

Often cannot explain the steps of thinking

Understands all or nothing

Once the "Aha" occurs, learning is relatively permanent

STRATEGIES FOR LECTURES

Pause to allow words to register

Allow student to tape record lectures

Encourage child to take notes in pictorial format

Encourage student to take notes in the 1/3 - 2/3's format

Emphasize concepts not details i.e. dates

Distribute handouts - don't expect these students to take dictation

Intuition and Discovery Learning

- Science Experiments - avoid the norm
  - Did the heat cause the change?
    vs.
  - What do you think caused the change?
- Engineering Process
  - Design – avoid the temptation…"That won't work."
  - Create
  - Test
  - Redesign - How often do we use this step?
- Discovery Learning-tell child the goal of the instruction and let him figure out a way to get there
- Allow opportunities for inductive learning

On the Job Training

- Mentorships
- Opportunities to act like a practicing professional
- Problem Based Learning

COLOR!

Have the child use highlighters to highlight directions or key concepts.

Color coordinate everything that has to do with one subject i.e. purple math book cover, purple notebook, purple portfolio, etc.

Use overheads or white board with a variety of color; categorize by color.

Have the visual spatial child create his own flashcards in color.

Copy worksheets and study guides on colored paper, it is easier to keep organized and easier on the eyes.

Organizational strategies

Color code calendars, assignments, books and supplies

Use an hourglass to visualize the passage of time

Make sure they have watches that are reliable

Teach them to "take a picture" of assignments as they are given

Help them learn to look up to their recall side to remember what it is they need to do

Teach them how to create priority lists and schedules - they may not like it but it is an essential survival skill!

Teacher-Student Interaction

Teach the child to become a spy and notice what is going on in the classroom
- take clues from classmates

Don't spy on just any student, some are better choices than others!

Institute a moment of silence at the end of class so students can visualize what they will need for homework

- this works well for all children in the class

- take a few deep breaths and relax then picture what happened during the day and what they will need to take home

Reduce unpredictable noise - music works well as it is predictable

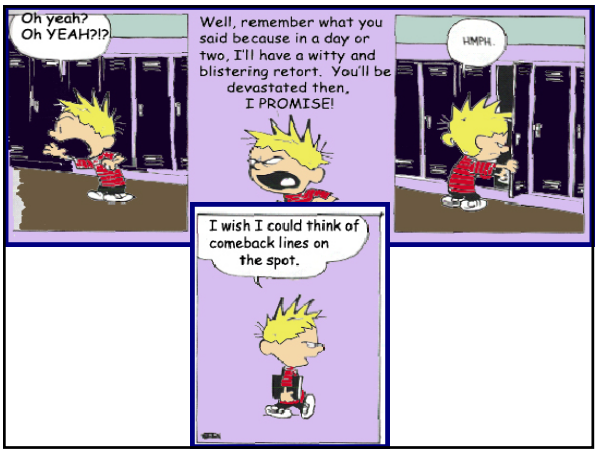
Walkman (make that IPod!) ground rules

- must be working continually
- must be appropriate music
- must be quiet so no one else can hear it
- must not start singing

Use wait time

Allow time for the child to translate the spoken word to images

It may take a visual spatial child longer to begin to answer the question than it took you to ask it.



IEP???

504???

And Remember…

Encourage the child's strengths, don't dwell on his weaknesses. This can be difficult as their strengths are outside of the traditional educational system

Allow for their learning style but don't allow them to use their learning style as an excuse.

And most of all…..

Believe in these children, they may well be the future Edisons and Einsteins of the world.