

Children with Spatial Strengths: Overlooked Engineers, Mathematicians and Scientists

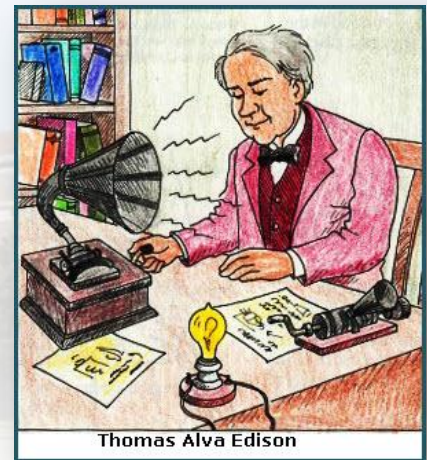
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Einstein



da Vinci

Edison



- ❑ 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

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 2006:

Only 6% majored in engineering

Fewer than 1% 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)

Who are these children?

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

DENNIS THE MENACE By Hank Ketcham



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

**Spatial Learners tend to:
Pull everything apart...**

**Visual Spatial Learners enjoy:
Blocks and Boxes
Construx
Legos
Computers
Daydreaming
Gears
Tinker Toys
Movies**



Sequential

Good organization

**Progresses from easy
to difficult**

Needs repetition

Early Bloomer

Does well with Algebra

Academic talent

Spatial

Organizationally impaired

**Gets difficult concepts,
struggles with easy**

Learning sticks

Late Bloomer

Does well with Geometry

Technology/Creative talent



Profoundly influenced by time

Preoccupied with space

Western thought

Eastern thought

Rapid processor

Slow processor

Step by step

Whole to part

Learn by trial and error

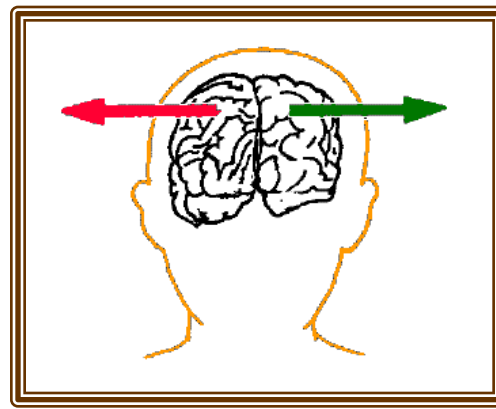
Learns concept all at once

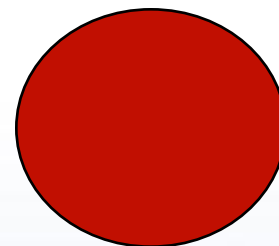
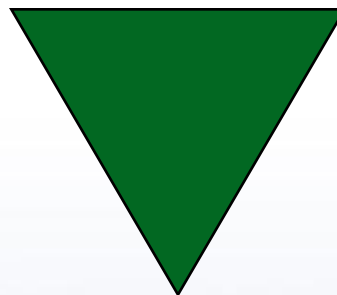
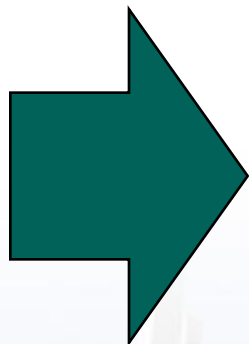
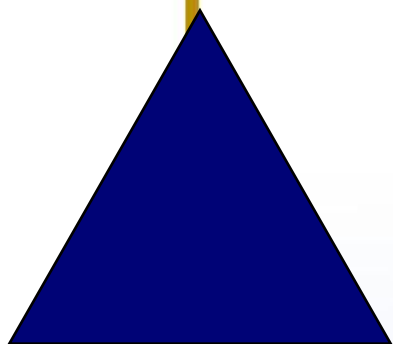
Phonics

Sight words

Left Brain

Right Brain





How do they learn?



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





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

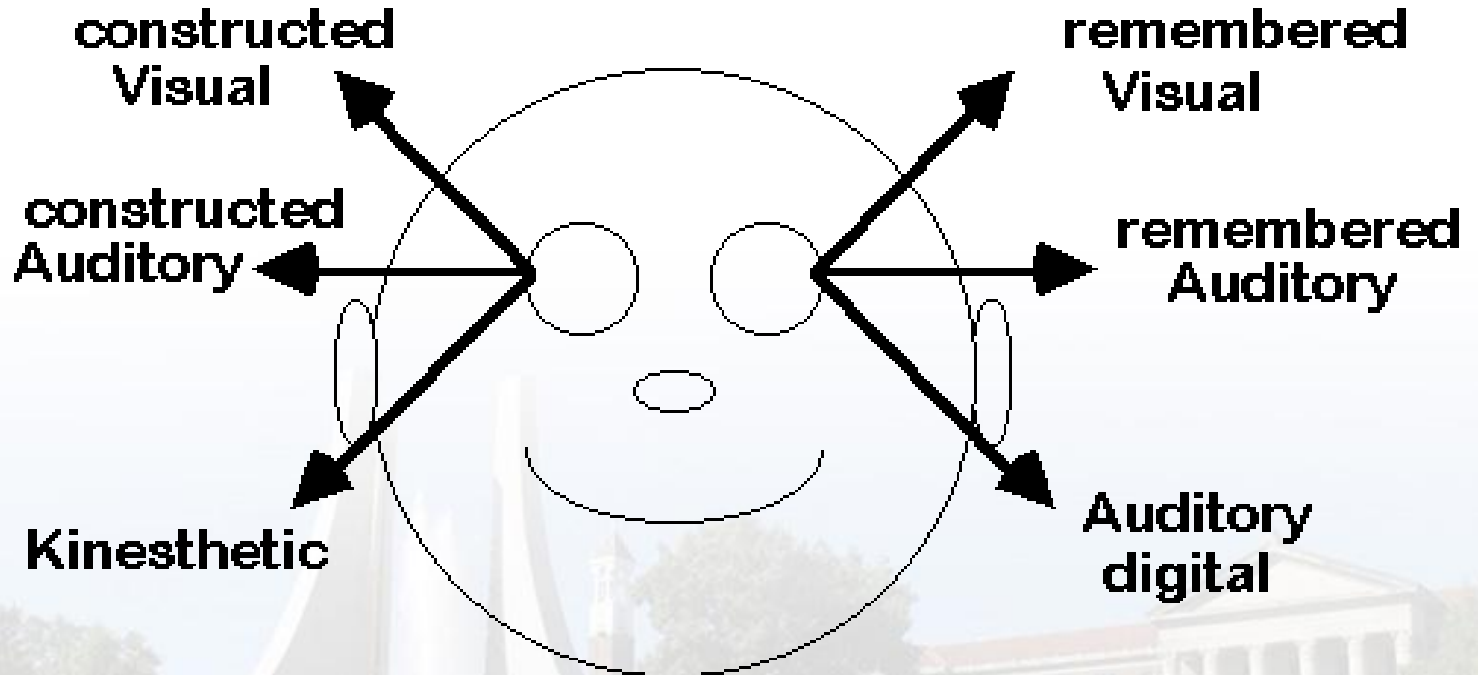
Ask yourself, “How would I teach this concept to a deaf child?”



8 U \$ D E 6 &



Neuro-Linguistic Programming



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

Whole to Part

Often perceived as “slow processors”

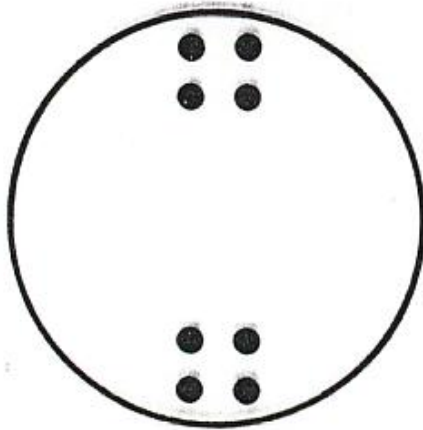
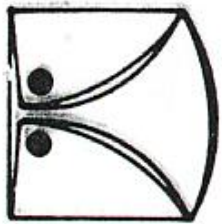
Perceive relationships between parts and whole

Don't understand if learning is doled out in small chunks

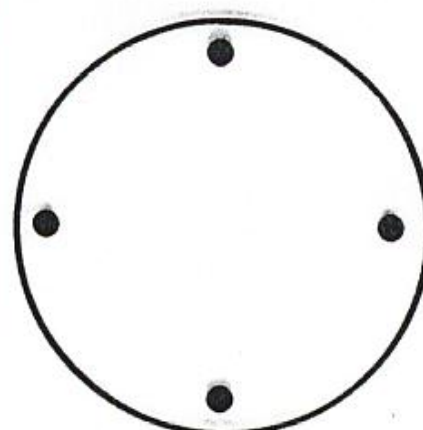
Can't grasp isolated facts until the big picture is in view

Have difficulty attending to details

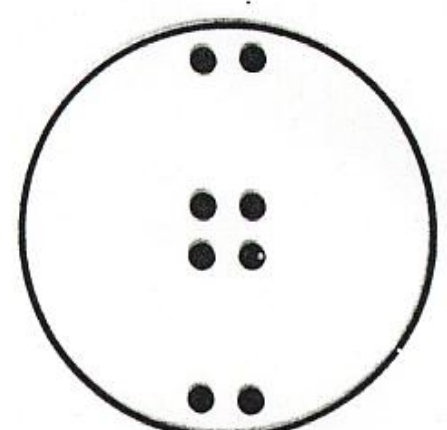




a



b

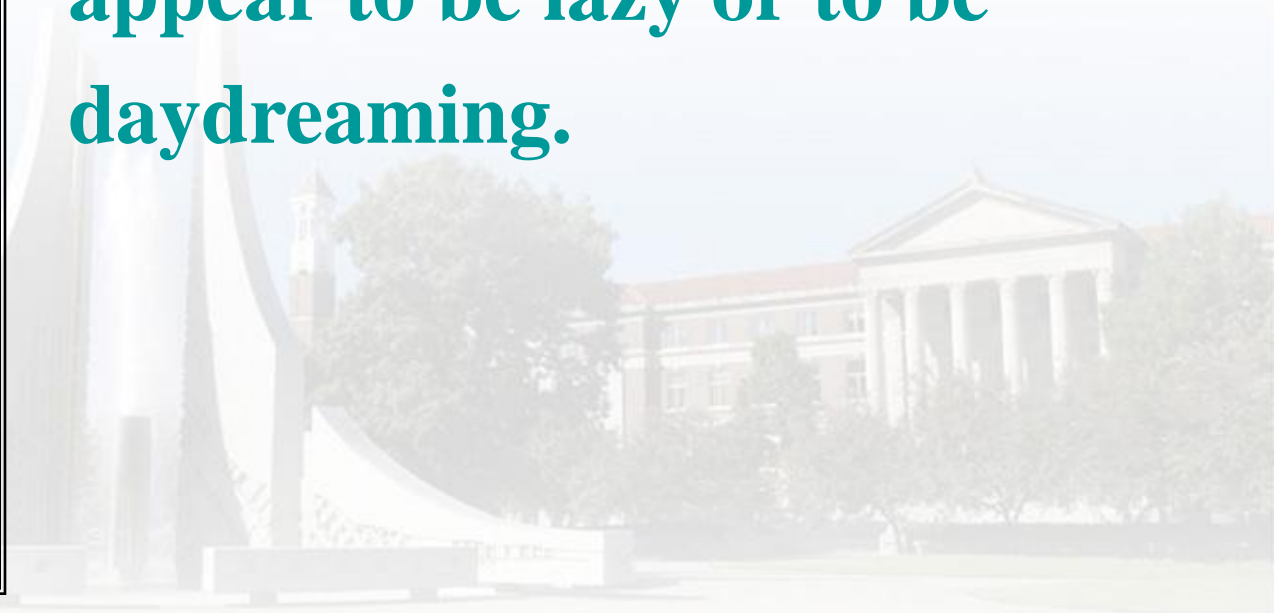
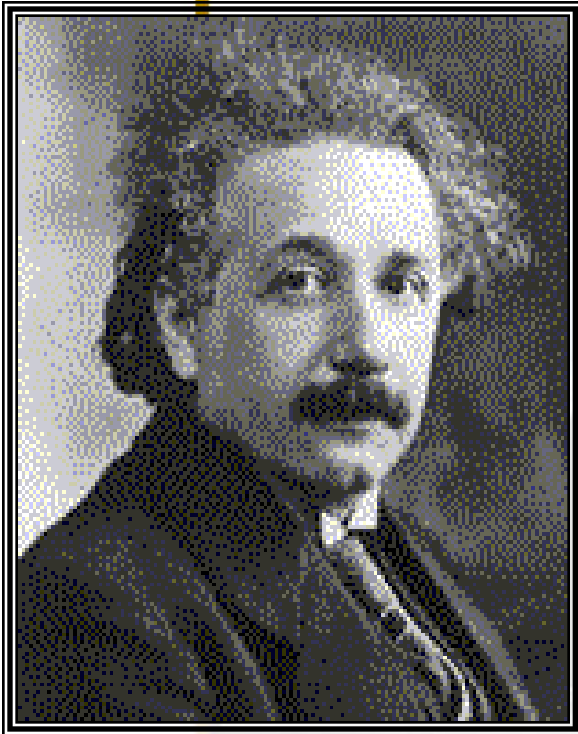


c



Spatial Learners are reflective:

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



Explain major concepts so child understands instructional goal

Provide real life scenarios - service oriented projects are good

Use a multidisciplinary emphasis



Concepts vs. computation

$$2 + 8 =$$

$$5 + 5 =$$

$$6 + 4 =$$

$$4 + 5 =$$

$$3 + 7 =$$

$$3 + 8 =$$

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

The report card of a highly visual spatial learner

Grade 3A Semester Second 1933

Teacher _____

| | | | | |
|------------------|----|---|----|---|
| Days Absent..... | 22 | 6 | 32 | |
| Times Tardy..... | 0 | 0 | 0 | |
| Arithmetic..... | A | A | B | A |

Computation

Concepts

Home Room 212 Grade 2B Semester 1st 1941-42

| PERIODS | 1 | 2 | 3 | 4 | Exam. | FINAL | No. Cr. |
|--------------------------------|---|---|---|---|-------|-------|---------|
| Half Days Absent..... | 1 | 3 | 5 | 1 | | | |
| Times Tardy..... | 0 | 0 | 1 | 0 | | | |
| English | | | | | | | |
| French | | | | | | | |
| Latin..... | | | | | | | |
| Spanish <u>4</u> | B | A | B | B | a | B | 1 |
| Journalism..... | | | | | | | |
| Debate | | | | | | | |
| Dramatics | | | | | | | |
| Public Speaking <u>I</u> | C | B | C | A | B | B | 1 |
| Algebra | | | | | | | |
| Geometry..... | | | | | | | |
| Com'l Arithmetic..... | | | | | | | |
| Trigonometry..... | B | A | A | A | a | a | 1 |
| Practical Math..... | | | | | | | |





A



B



C



1



2



3



4

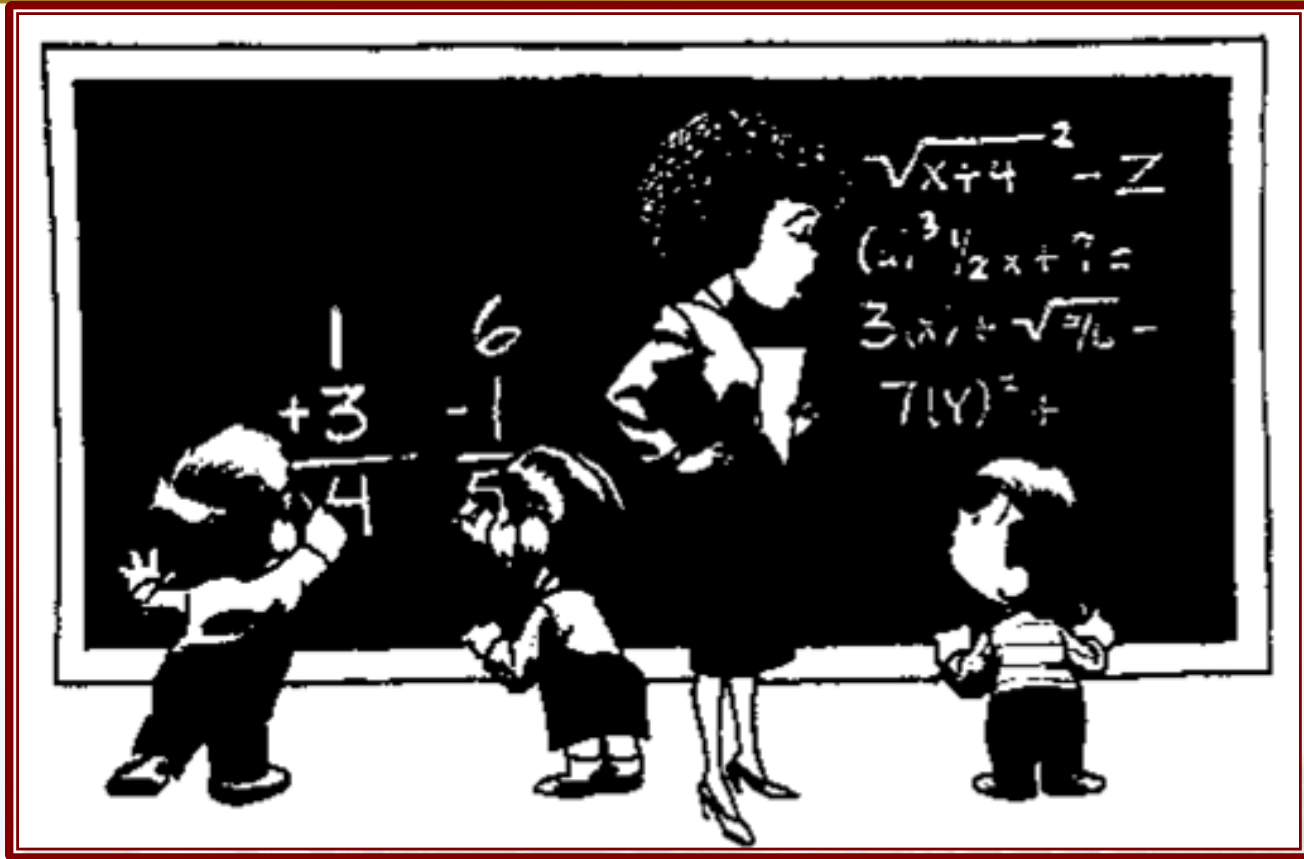


5



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.**

- 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

$56=7 \times 8$

$4 \times 9=6 \times 6$

- 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



Domino Math



| | | | | | | |
|---------------|---------------|--|--|--|--|--|
| $\frac{6}{6}$ | $\frac{0}{0}$ | | | | | |
| $\frac{5}{6}$ | $\frac{0}{1}$ | | | | | |
| $\frac{4}{6}$ | $\frac{0}{2}$ | | | | | |
| $\frac{3}{6}$ | $\frac{0}{3}$ | | | | | |

Use 28 dominoes and make each row equal the same amount.

If you can read this
easily, you may be
a visual spatial learner.



Often cannot explain the steps of thinking

Understands all or nothing

Once the “Aha” occurs, learning is relatively permanent

SPICES



Intuition and Discovery Learning

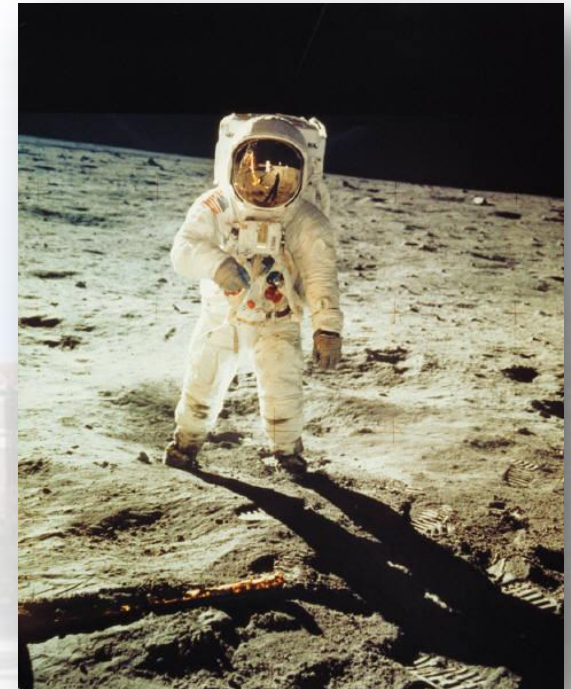


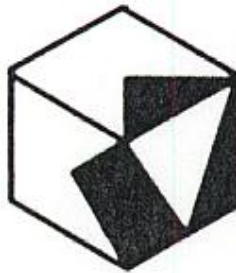
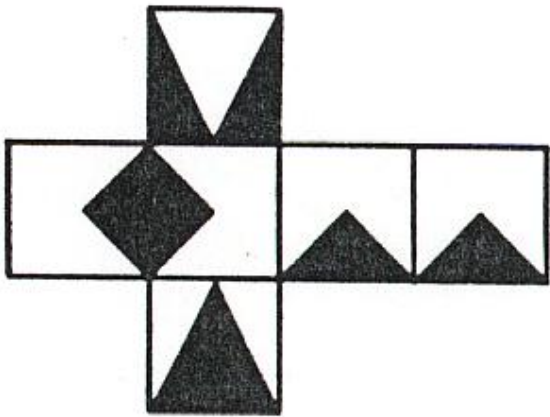
- Science Experiments - avoid the norm
 - Did the heat cause the change?
- vs.
- What do you think caused the change?
- Engineering Process
 - Design - avoid the temptation...“That won’t work.”
 - Create
 - Test
 - Redesign - How often do we use this step?
- Discovery Learning-tell child the goal of 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
- Interact Simulations





a



b



c



d





Color code calendars, assignments, books and supplies

Use an hourglass to visualize the passage of time

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!

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

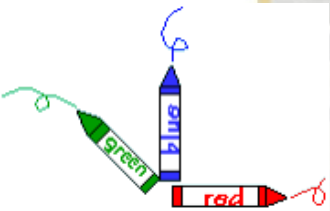
Color coordinate everything that has to do with one subject

i.e. purple math book cover, purple notebook, purple portfolio, etc.

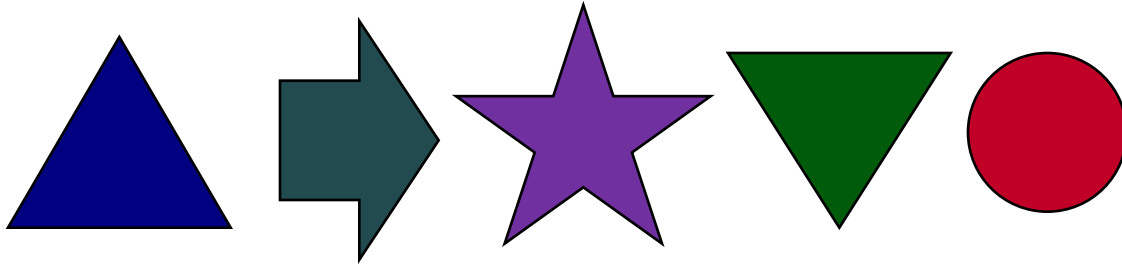
Use overheads or white board with a variety of color; categorize by color.

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

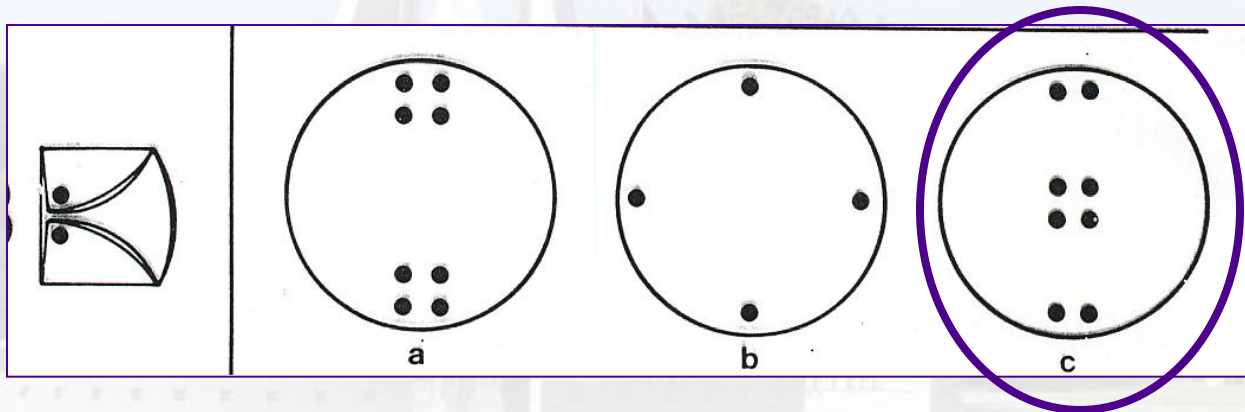
Copy worksheets and study guides on colored paper, it is easier to keep organized and easier on the eyes.



THE ANSWERS!



8 U \$ D E 6 &





A



B



C



1



2



3

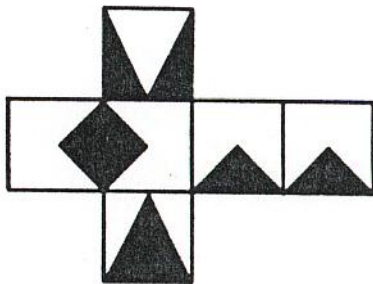


4



5

If you can read this easily, you may be a visual spatial learner.



a



b



c



d

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 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.

Oh yeah?
Oh YEAH?!?



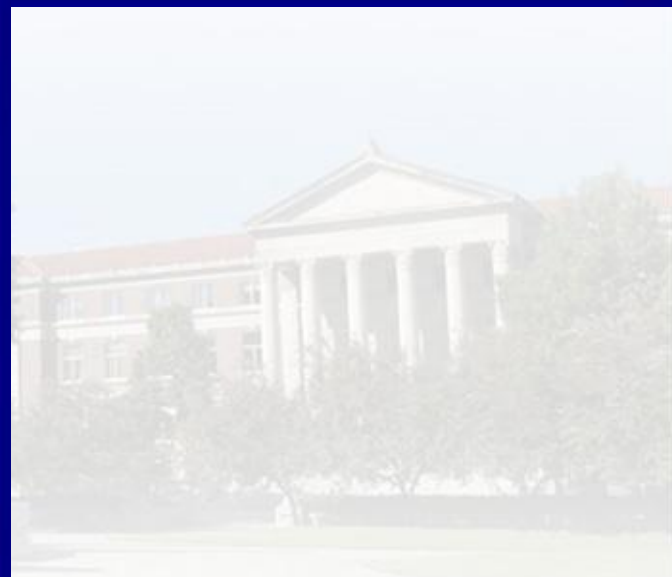
Well, remember what you said because in a day or two, I'll have a witty and blistering retort. You'll be devastated then, I PROMISE!



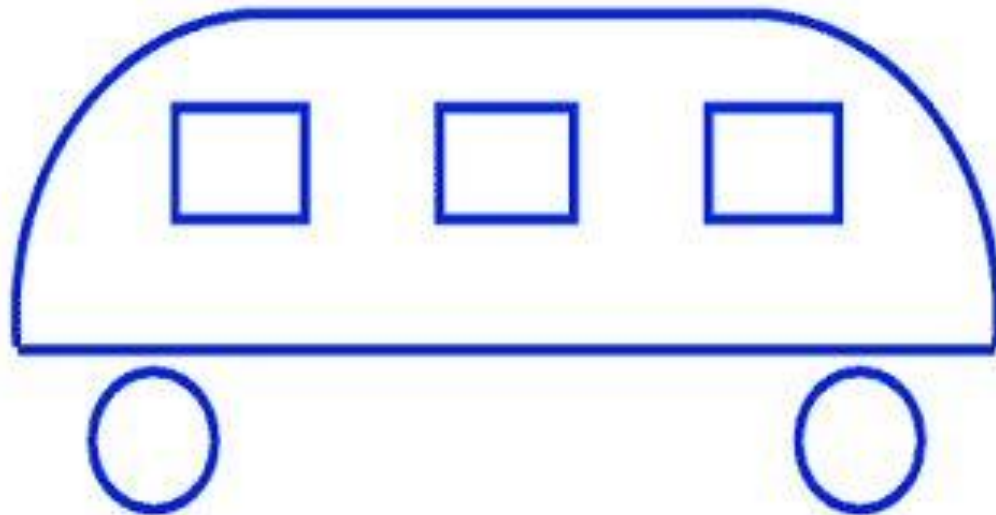
HMPH.



I wish I could think of comeback lines on the spot.



**Pre-school children were asked question:
"In which direction is the bus pictured below
traveling?"**



(The only possible answers are "left" or "right.")



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.