Upside-Down Brilliance: Strategies for Visual-Spatial Learners

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Nieuwegein, The Netherlands
September 28, 2016

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EFFECTIVE TECHNIQUES FOR TEACHING GIFTED VISUAL-SPATIAL LEARNERS

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Spatial preference and sequential preference are two different mental organizations that affect perceptions and apparently lead to different world views. Information deemed central to one viewpoint appears irrelevant from the other perspective. The sequential system appears to be profoundly influenced by audition, whereas the spatial system relies heavily on vision and visualization. Auditory-sequential learners are extremely aware of time but may be less aware of space; visual-spatial learners are often preoccupied with space at the expense of time. Sequential learning involves analysis, orderly progression of knowledge from simple to complex, skillful categorization and organization of information, and linear, deductive reasoning. Spatial learning involves synthesis, intuitive grasp of complex systems (skipping many of the foundational "steps"), simultaneous processing of concepts, inductive reasoning, active use of imagery, and idea generation by combining disparate elements in new ways. These diverse ways of relating to the world have had powerful ramifications throughout history in the development of various philosophies, religions, cultures, branches of science, and psychological theories.

Western and Eastern philosophies and cultures provide dramatic examples of these differences. Western thought is sequential, temporal, analytic; Eastern thought is spatial and holistic (Bolen, 1979). Cause and effect sequences are stressed in Euro-American ideation, whereas synchronicity of unrelated events is appreciated from an Asian world view. Western languages are constructed out of non-meaningful elements—letters of the alphabet; Eastern languages traditionally have been composed of pictorial representations. Perhaps the greater facility of Asian children in the visual-spatial domain can be traced at least in part to the emphasis on visualization in the linguistic system.

Temporal, sequential and analytical functions are thought to be left-hemispheric strengths, while spatial, holistic and synthetic functions are considered right-hemispheric strengths (Dixon, 1983; Gazzaniga, 1992; Springer & Deutsch, 1989; West, 1991). However, most researchers agree that *integration of both hemispheres is necessary for higher-level thought processes*. We all use both hemispheres, but not with equal facility. Highly gifted individuals show strong integration of sequential and spatial functions, but most of the gifted children we have assessed seem naturally to favor one or the other mode.

These different mental organizations appear to be innate. Although one can gain more facility with one or the other mode through learning, it is unlikely that a person with sequential preference can learn to perceive the world in exactly the same way as an individual with spatial preference or vice versa. Instead of trying to remake one or the other style of learning, we need to accept these inherent differences in perception, and appreciate their complementarity since we inhabit a spatial-temporal reality. When these differences are not understood, there is dissension; when they are honored, they enable an exchange of information that forms a more complete conception of reality than can be gained by either perspective in isolation.

Characteristics

Individuals who exhibit stronger visual-spatial abilities than auditory sequential abilities are considered visual-spatial learners. They do extraordinarily well on tasks with spatial components: solving puzzles, tracing mazes, duplicating block designs, counting three-dimensional arrays of blocks, visual transformations, mental rotations, envisioning how a folded and cut piece of paper would appear opened up, and similar items. The Block Design subtest of the *Wechsler Intelligence Scale for Children* (WISC) is one of the strongest indicators of the visual-spatial learning style. Raven's *Progressive Matrices* also assess spatial abilities. The *Mental Rotations Test* has been used in several studies to detect individuals with extremely strong visual-spatial and mathematical talents.

Visual-spatial learners perceive the interrelatedness of the parts of any situation. Their learning is holistic and occurs in an all-or-none fashion. They are most likely to experience the “Aha!” phenomenon, when all of a sudden they “see it.” Many have a photographic visual memory: they can visually recall anywhere they have ever been and how to get there. This type of learning does not take place through a series of steps. Sequential skills are usually reserved as a back-up system when they cannot grasp a concept through their preferred mode of apprehending the entire gestalt. They may create visual models of reality that are multi-dimensional.

As toddlers, these children like to see how things work, and they enjoy pulling things apart to see if they can reconstruct them. When given an ordinary toy, they play with it long enough to figure out how it works, and most likely never touch it again. They enjoy novelty and challenge. Visualization is a key element in the mental processing of visual-spatial learners. If they are introverted, they rehearse everything mentally before they attempt it: walking, talking, reading, riding a bicycle, etc. Visual-spatial children are usually fascinated with puzzles and mazes, and have expert facility with them. They spend endless hours building with construction toys (blocks, LEGO sets, tinker toys) or other materials, and their constructions are often quite sophisticated and intricate in design. Given the opportunity, these children often begin quite young to have a lifelong love affair with numbers and numerical relations.

Spatial abilities underlie both mathematical talent and creativity, and are essential in a number of fields: mathematics, science, computer science, technological fields, architecture, mechanics, aeronautics, engineering, surgery, design and most creative endeavors (visual arts, music, etc.). Unfortunately, visual-spatial learners may dislike school because of the overemphasis on lecturing, rote memorization, drill and practice exercises, and the lack of sufficient stimulation of their powerful abstract visual reasoning abilities. Lectures are more appropriate for auditory-sequential learners, unless visual aids are used. Rote memorization and drill are effective strategies for concrete auditory-sequential learners, but they are counterproductive to the learning style of visual-spatial learners. Learning, for visual-spatial learners, takes place all at once, with large chunks of information grasped in intuitive leaps, rather than in the gradual accretion of isolated facts, small steps or habit patterns gained through practice. For example, they can learn all of the multiplication facts as a related set in a chart much easier and faster than memorizing each fact independently.

Once learning takes place, it creates a **permanent** change in the child's awareness and understanding. In this case, practice does not make perfect; it is completely unnecessary for the student's learning style and it deadens the child's natural interest in a subject. When a student with powerful abstract reasoning abilities is asked to use only the simplest mental facility of rote memorization, much of the potency of the child's intelligence remains unused. When the gifted child is given more stimulating, advanced, complex material to learn, and the material is presented at a faster pace, then the child's natural gift of abstract reasoning is exercised and developed. Gifted spatial learners thrive on abstract concepts, complex ideas, inductive learning strategies, multidisciplinary studies, holistic methods, and activities requiring synthesis; they are natural pattern finders and problem solvers. When educated according to their learning style, they are capable of original, creative thought.

Strategies for Instruction

The following strategies have been found to be effective in teaching children with visual-spatial strengths:

1) Use visual aids, such as slides, and visual imagery in lectures.
2) Use manipulative materials to allow hands-on experience.
3) Use a sight approach to reading before teaching phonics.
4) Use a visualization approach to spelling: show the word; have them close their eyes and visualize it; then have them spell it *backwards* (this demonstrates visualization); then spell it forwards; then write it once.
5) Have them discover their own methods of problem solving (e.g., instead of teaching division step-by-step, give them a simple division problem, with a divisor, dividend and quotient. Have them figure out how to get that answer in their own way. When they succeed, give them a harder problem with the solution already worked out and see if their system works).
6) Avoid rote memorization. Use more conceptual or inductive approaches.
7) Avoid drill and repetition. Instead, have them perform the hardest items.
8) Find out what they have already mastered before teaching them.
9) Give them advanced, abstract, complex material at a faster pace.
10) Allow them to accelerate in school.
11) Emphasize mastery of higher level concepts rather than perfection of simpler skills in competition with other students.
12) Emphasize creativity, imagination, new insights, new approaches rather than mere acquisition of knowledge. Creativity should be encouraged in all subjects.
13) Group gifted visual-spatial learners together for instruction.
14) Engage students in independent studies or group projects that involve problem-finding as well as problem-solving.
15) Allow them to construct, draw, or otherwise create visual representations of concepts.

16) Use computers so that material is presented visually.
17) Have the students discuss the ethical, moral and global implications of their learning and involve them in service-oriented projects.

Visual-spatial learners are more attentive if they understand the goals of instruction. They are more cooperative at home and at school if they are allowed some input into decision-making process and some legitimate choices. Discipline must be private, as these children are highly sensitive and easily humiliated. If they are respected, they will learn to treat others with respect. When they are placed in the right learning environment, where there is a good match between their learning style and the way they are taught, visual-spatial learners can actualize their potential to become innovative leaders.

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Note: For more information, please see Silverman, L. K. (1979). The visual-spatial learner. *Preventing School Failure, 34*(1), 15-20. Our website, www.VisualSpatial.org, has free downloads of teaching strategies.

BIO: Linda Kreger Silverman, Ph.D., is a licensed clinical and counseling psychologist. She directs the Institute for the Study of Advanced Development, and its subsidiaries, the Gifted Development Center [www.gifteddevelopment.com] and Visual-Spatial Resource [www.visualspatial.org], in Denver, Colorado. In the last 37 years, she has studied over 6,300 children who have been assessed at GDC from all over the world—the largest data bank on this population. Her research enabled the creation of extended norms on the WISC-IV. Her Ph.D. is in educational psychology and special education from the University of Southern California. For nine years, she served on the faculty of the University of Denver in counseling psychology and gifted education. She has been studying the psychology and education of the gifted since 1961 and has written over 300 articles, chapters and books, including *Counseling the Gifted and Talented*, *Upside-Down Brilliance: The Visual-Spatial Learner* and *Advanced Development: A Collection of Works on Gifted Adults.* Her latest book, *Giftedness 101* (New York: Springer, 2013) went into its third printing within six months of its release. It has been translated into Korean and Swedish.

Teaching Mathematics to Non-Sequential Learners

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In our case files, we have hundreds of students who show superior grasp of mathematical relations, but inferior abilities in mathematical computation. These students consistently see themselves as poor in mathematics and most hate math. This situation is terribly unfortunate, since their visual-spatial abilities and talent in mathematical analysis would indicate that they are “born mathematicians.”

Visual-spatial abilities are the domain of the right hemisphere; sequential abilities are in the domain of the left hemisphere. Test performance patterns demonstrated by underachieving visual-spatial learners seem to indicate unusual strengths in right-hemispheric tasks, and less facility with left-hemispheric tasks. In order to teach them, it is necessary to access their right hemispheres. This can be done through humor, use of meaningful material, discovery learning, whole/part learning, rhythm, music, high levels of challenge, emotion, teaching to their interests, hands-on experiences, fantasy and visual presentations.

Sequentially-impaired students cannot learn through rote memorization, particularly series of numbers, such as math facts. Since the right hemisphere cannot process series of non-meaningful symbols, these spatially-oriented students must picture things in their minds and see meaningful relationships. Mental pictures disappear under pressure, such as timed tests. Their minds seem to freeze, and they are unable to access information that has been stored visually.

I have found that students can learn their multiplication facts in less than two weeks if they are taught within the context of the entire number system. I have them complete a blank multiplication chart as fast as they can, finding as many shortcuts as possible. That may take some assistance, but it enables them to see the whole picture first, before we break it down into parts. I ask them to look for shortcuts to enhance their ability to see patterns.

First, we complete the rows and columns of zeros, since anything times 0 equals 0. Then we complete the rows and columns of 1s, since anything times 1 equals itself. Then, we do the tens and the student happily announces that these are easy, since you just put a zero after the multiplier. Many visual-spatial students can skip count by their 5s, because 0, 5, 0, 5 is rhythmic and an easy pattern to see. Then I ask them to count by 2s. If they count by 2, they can multiply by 2.

At some point, the student may notice that one half of the chart is a mirror image of the other half. When we fold it on the diagonal, from the top left corner to the bottom right corner, this becomes even clearer. I ask how this happens and the student discovers the commutative principle: that a x b = b x a. This certainly cuts down on the task of memorization considerably! If one knows 4 x 6 = 24, one also knows that 6 x 4 = 24.

Next, I teach one of several shortcuts for multiplying by 9s. The easiest one I know is to subtract one from the number of nines being multiplied, then find a number which, when added to the first number, results in the sum of nine. For example, in 8 x 9, the following process would occur: subtract 1 from 8, leaving 7. What plus 7 equals 9? (2). The answer is 72, since 7 is one less than 8, and 7 plus 2 add up to 9.

There are other tricks for memorizing the 9s times tables, including the finger method found in *Upside-Down Brilliance: The Visual-Spatial Learner* (page 304). Visual-spatial students are excellent at seeing patterns and there are patterns galore in the 9s column. For example, every answer has a mirror image. Also, as the tens column increases by one digit, the ones column decreases by one digit:

09
18
27
36
45
54
63
72
81
90

Note that 09 at the top is the mirror image of 90 at the bottom, and so forth. The tens column is 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, while the ones column is 9, 8, 7, 6, 5, 4, 3, 2, 1, 0.

There are several other tricks. They can remember that you have to be 16 do drive a 4 x 4 (4 x 4 = 16)! Also, 1, 2, 3, 4 is 12 = 3 x 4 and 5, 6, 7, 8 is 56 = 7 x 8. Rhyming equations are easy to recall: 6 x 4 = 24, 6 x 6 = 36, 6 x 8 = 48. Another benefit to these tricks is that students learn division at the same time. If you have a picture of being 16 to drive a 4 x 4, you can simultaneously see that 16 divided by 4 equals 4. I try to teach them all of the doubles at one time, from 2 x 2 to 9 x 9. Doubles seem to be easier than some of the others, since they have a natural rhythm.

Young children like to play games where they count by 3s. There is also a video from Schoolhouse Rock called *Multiplication Rock,* which has catchy tunes for memorizing math facts, particularly the 3s. Also, the 3's can be learned to the tune of *Jingle Bells: "3, 6, 9 – 12, 15 – 18, 21 – 24, 27 – 30 and you're done!"* Sixes can be taught as doubles of threes. These tricks reduce the number of difficult math facts to less than ten.

I ask students to make up a real problem for each of the remaining math facts with which they have difficulty. I ask them to draw a picture for each problem. The picture needs to include something they are emotionally attached to, such as a favorite animal or food. For example, if they love ice cream, and they are trying to learn 3 x 7, I ask them to draw 7 ice cream cones, each with 3 scoops of ice cream. They write, "3 x 7" at the top of their picture and "7 x 3" at the bottom and then count up all the scoops to arrive at the answer. For 4 x 6, they might draw 6 horses and give each of their horses 4 carrots. They put these pictures up on the wall in their bedroom until they've created a permanent mental image.

These methods bring the facts to life, enabling students to visualize them and create meaningful associations for them. Manipulatives and calculators should also be encouraged. Students should be informed that mathematics is more than calculation. Those who have difficulty with multiplication may be brilliant at geometry, which is not as sequential. Algebra and chemistry are highly sequential, but geometry and physics are spatial. Students with right-hemispheric strengths should be introduced to geometric and scientific principles at the same time that they are struggling with calculation so that they do not come to see themselves as mathematically incapable. In a world of calculators and computers, the computational wizard is all-but-obsolete.

Division is often quite difficult for these students, since it is usually taught in a step-by-step fashion and these students are lost after the second step. They are not step-by-step learners. They would learn much more rapidly if they were simply given a divisor, a dividend and a quotient and asked to figure out their own method of arriving at the quotient. *Don't ask them to show their steps.* Just give them another problem with the solution already worked out and see if their system works. Gradually increase the level of the problems to test their system. This way of teaching is a lot like the methods used in video games. Even in adult life, these individuals will do beautifully if they know the goal of an activity, and are allowed the freedom to find their own methods of getting there.

Timed tests should be avoided, since it takes longer for visual-spatial learners to translate their images into words. *Timed activities should only be used if students are competing with themselves rather than others.* If a student has difficulty completing assignments in the same time frame as classmates, a comprehensive assessment should be conducted to determine if the student has a processing speed problem. The teacher should allow more time for assignments and reduce the amount of homework. Record any accommodations in the student's permanent record. In the United States, this will assist the student in qualifying to take College Board examinations with extended time. With this type of assistance, non-sequential learners can blossom and become highly successful.

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x	0	1	2	3	4	5	6	7	8	9	10	
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A VISUALIZATION APPROACH TO SPELLING*

Linda Kreger Silverman, Ph.D.

1. Write the spelling word in large print in bright colored ink on a card. Put the letters that are most difficult to remember in a different color.

2. Hold the card at arm's length, slightly above eye level.

3. Study the word, then close your eyes and picture the word in your mind's eye.

4. Do something wild to the word in your imagination. (The sillier the better!)

5. Place the word somewhere in space (in front of you or above your head).

6. Spell the word backwards with your eyes closed.

7. Spell the word forwards with your eyes closed.

8. Open your eyes and write the word *once*.

***Borrowed from Neurolinguistic Programming (NLP).**

How to Turn on the Right Hemisphere

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1. **Use humor whenever possible. Humor gets the right hemisphere into the act.**

2. **Present it visually. Use slides. Draw pictures. Show them—don't just tell them. Have them picture it.**

3. **Use computers. Computers *show* rather than tell. They teach visually with no time limits.**

4. **Make use of fantasy. Provide lots of opportunities for students to use their imaginations!**

5. **Use hands-on experiences: manipulatives, construction, movement, action.**

6. **Make it challenging. Challenge integrates the two hemispheres.**

7. **Use discovery techniques: finding patterns, inductive learning, inquiry training.**

8. **Put it to music. Let them sing it! Let them dance it! Let them chant it! Rhythm will be remembered.**

9. **Get their attention! Talk louder, talk faster, be more animated, use gestures. Do something silly.**

10. **Make them winners. Involve them in a competition they are guaranteed to win: Read one more book than last week; Beat your speed at math facts.**

11. **Teach to their interests. Find out what turns them on. What are their hobbies? What do they do after school? What do they want to be when they grow up?**

12. **Emotion works wonders. Use emotionally charged material. Show them you care about them.**