

Multiple Intelligence in Science Education



Multiple Intelligence in Science Education

- The citizens of the 21st century will not grow, by simply mastering literacy and computation; they will need to be real-world problem solvers who understand how to access and manipulate all kinds of information in many flexible ways in order to be productive.
- Traditionally, it has been assumed that people have two kinds of intelligence:
 - **mathematical** and,
 - **verbal**.

Multiple Intelligence in Science Education

- These two kinds of intelligence accepted for a long time because they were easy to design curriculum around for the schools and they were measurable with standardized tests.
- For almost a century psychometricians, or intelligence testers, had seen it as a fixed trait-IQ tests demonstrated that you were either "smart," "normal," or "deficient."

Multiple Intelligence in Science Education

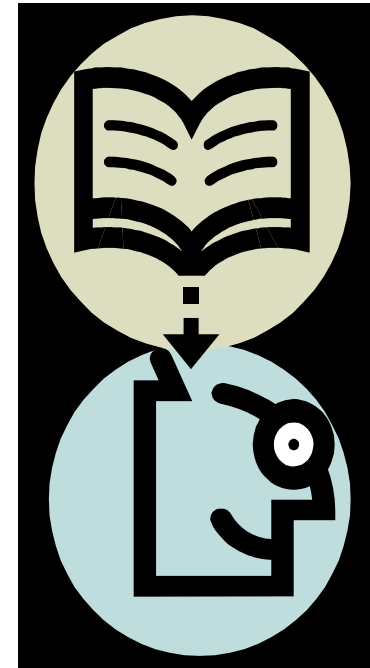
- For years, teachers recognized that traditional measures of intelligence, such as an IQ test, may have been good at predicting a student's school performance, but these tests did not accurately represent and assess the variety of ways in which people **learn**.
- **There are many ways to be smart** and to achieve success in life and in school.

Multiple Intelligence in Science Education

- School achievement is usually thought of as being "book smart" and "doing well in reading, writing and arithmetic ". However, people can also have a "talent" and be successful at playing a sport, a musical instrument, making art or singing.
- “Common sense” and "street smarts" are also important abilities that allow us to understand people or master crafts such as woodworking and sewing.
- People who understand themselves are often called “**wise**”.
- So, it is important to respect all these “**different ways of being smart**” in order to help each person find what they are “**best**” at doing and to **maximize achievement** in all activities.

Multiple Intelligence in Science Education

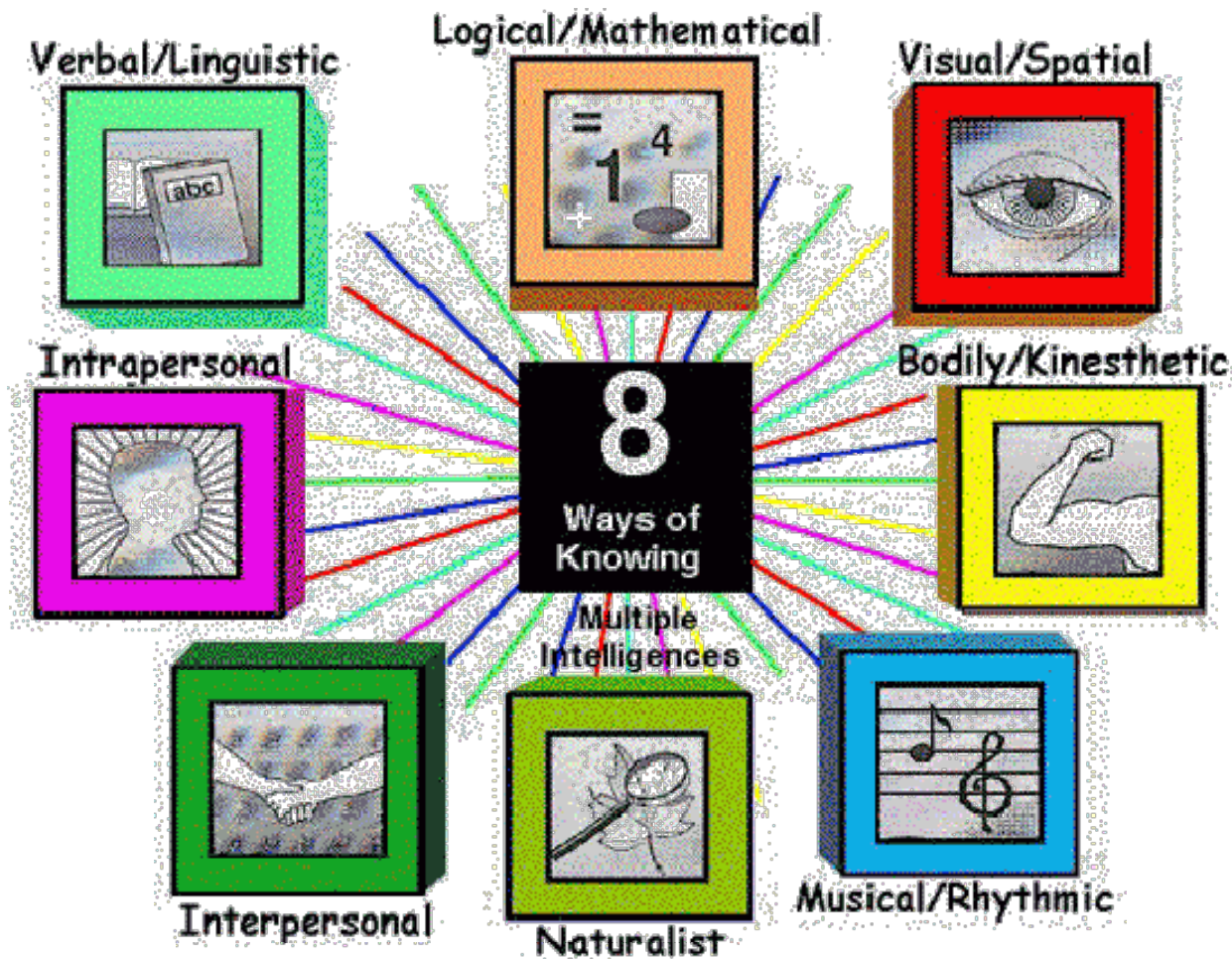
- For the ways of being successful, Howard Gardner use the name "**intelligences**" instead of "**smart**" or "**talent**".
- In 1983, he wrote the book "Frames of Mind" in which he argues that there is more to intelligence than just being "book smart." He says that there are more than eight different kinds of intelligence that help us to be successful in everyday life as well as in school.
- Dr. Gardner says that being smart means that you have the ability . . .
- ***"to solve a problem or to create a product or to provide a service
..... that is valued in your community".***



Multiple Intelligence in Science Education

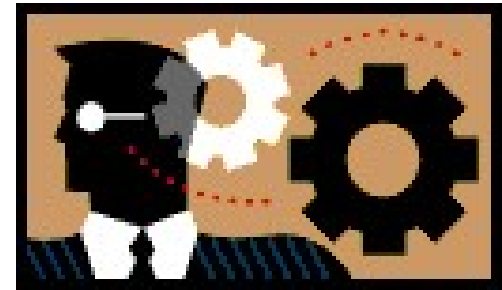
- Gardner identifies eight intelligences, all of which he considers "part of our birthright." He also adds that "no two people have exactly the same intelligences in the same combination." So it can be said that every student is unique.
- The extent to which the various intelligences develop in an individual depends (to a significant extent) on the individual's education and culture.
- The eight intelligences are linguistic, logical, musical, spatial, bodily kinesthetic, interpersonal, intrapersonal, and naturalistic.

Multiple Intelligence in Science Education

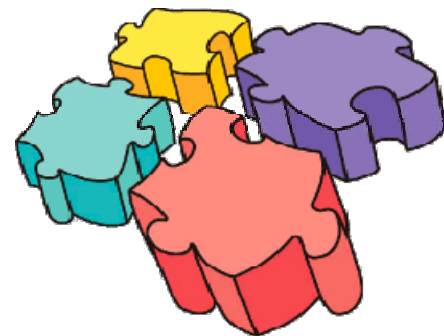
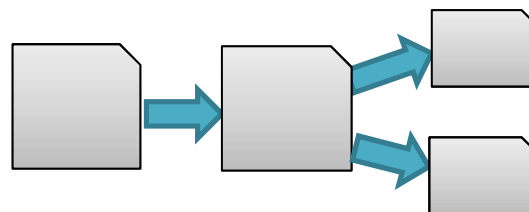


Logical/Mathematical Intelligence

“Number/Reasoning Smart”



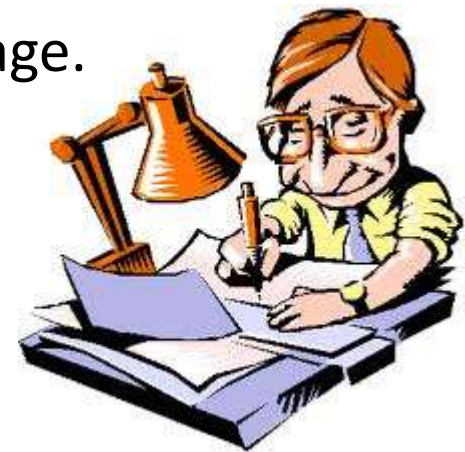
- It is related with the capacity to manipulate numbers or understand cause and effect relationships, and the ability to think logically and find out patterns.
- Individuals in this category are basically number reasoning smart. They are able to perform logical, abstract or sequential thinking very effectively.



Verbal-Linguistic Intelligence

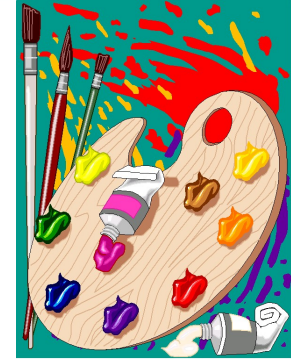
“Word Smart”

- The ability to use language, both oral and written, effectively.
- Linguistic intelligence is the ability to think in words and to use language to express and appreciate complex meanings. Linguistic intelligence allows us to understand the order and meaning of words and to apply meta-linguistic skills to reflect on our use of language.



Visual/Spatial Intelligence

“Picture Smart”



- The ability to think in pictures, images, shapes, and patterns.
- Spatial intelligence is the ability to think in three dimensions. Core capacities include mental imagery, spatial reasoning, image manipulation, graphic and artistic skills, and an active imagination.
- Individuals in this category are “picture smart”. They have strong ability to deduce three-dimensional objects. A person strong in this area is good with pictures and images.
- They have excellent visual receptive skills and excellent fine motor skills.



Bodily/Kinesthetic Intelligence

“Body Smart”



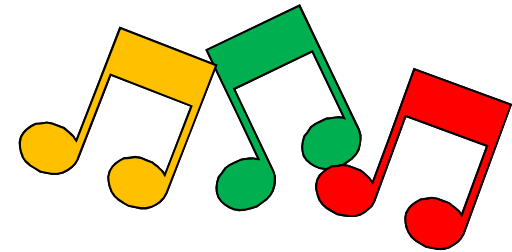
- The ability to use one's body, or parts of one's body, to solve a problem, create something, or put on a production
- This type of intelligence entails being “body smart”. Individuals with this form of intelligence usually are blessed with the ability to manipulate their bodies with great accuracy to be in synchrony with objects they are in contact with.
- They have a keen sense of timing and skill perfection.



Musical/Rhythmic Intelligence

“Music Smart”

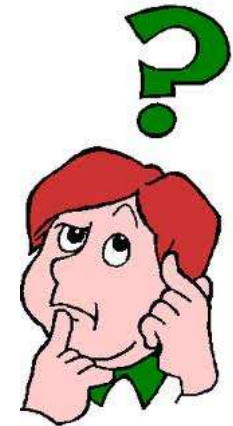
- Musical intelligence is the capacity to discern pitch, rhythm, timbre, and tone.
- This intelligence enables us to recognize, create, reproduce, and reflect on music, as demonstrated by composers, conductors, musicians, vocalist, and sensitive listeners.
- The ability to think in musical terms, hear and recognize patterns, discriminate between sounds, and create music.



Intrapersonal Intelligence

“Self Smart”

- The ability to understand yourself and relate to one's immediate surroundings
- Intra-personal intelligence is the capacity to understand oneself and one's thoughts and feelings, and to use such knowledge in planning and directioning one's life.
- Intra-personal intelligence involves not only an appreciation of the self, but also of the human condition.

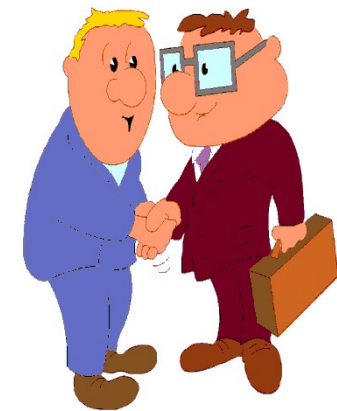


Interpersonal Intelligence

“People Smart”



- The capacity to understand, communicate, and relate to other people and groups.
- Interpersonal intelligence is the ability to understand and interact effectively with others.
- It involves effective verbal and nonverbal communication, the ability to note distinctions among others, sensitivity to the moods and temperaments of others, and the ability to entertain multiple perspectives.
- They are good leaders and usually have lots of friends.



Naturalist Intelligence

“Nature Smart”

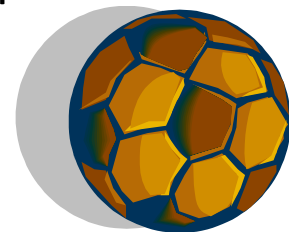


- The ability to discriminate among living things and to be in touch with one's natural surroundings
- Capability to work with and understand certain features of your environment
- Designates the human ability to discriminate among living things (plants, animals) as well as sensitivity to other features of the natural world (clouds, rock configurations).



Multiple Intelligence in Science Education

- **Gardner points** out that each intelligence as described above is actually a “fiction”; that is, no intelligence exists by itself in life. Intelligences are always interacting with each other.
- Foreexample, to cook a meal, one must read the recipe (linguistic), perhaps double the recipe (logical-mathematical), develop a menu that satisfies all members of the family (interpersonal), and prepare one's own meal well (intrapersonal).
- Similarly, when a child plays a game of kickball, she needs bodily-kinesthetic intelligence (to run, kick, and catch), spatial intelligence (to orient herself to the playing field and to anticipate the trajectories of flying balls), and linguistic and interpersonal intelligences (to successfully argue a point during a dispute in the game).



Implementation of Multiple Intelligence in Science Classes

- Multiple Intelligence allows (M.I.) teachers to personalize their instruction and create self-motivating lessons using the kids' natural abilities (Wilson, 1998).
- Individuals do not necessarily have the same strengths in each area or the same amalgam of intelligences. **Individuals can improve at each of the intelligences**, although some will improve in one area more readily than others.
- M.I. theory of learning helps individuals understand, respect, and value the ways in which they seem to learn more easily, and use those strategies to become a more successful learners.

Implementation of Multiple Intelligence in Science Classes

- Students learn better and easily when the teachers use different methods and techniques in the classes to teach science.
- By this way it is also possible to reach all students who have different ways of learning.

Implementation of Multiple Intelligence in Science Classes

- Poetizing, composing and expressing science subjects with a musical instrument are very enjoyable for them.
- Literature also shows that students are more successful in the studies that they found enjoyable (Shen, 1993; Karamustafaoğlu, 2003).

Implementation of Multiple Intelligence in Science Classes

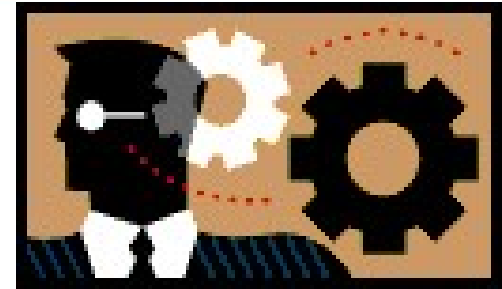
- Every good teacher wants to find better ways to motivate students and inspire quality learning in the classroom.
- Students enjoy tasks in which they can predict success.
- Since “understanding how students learn” is the crucial step in a providing a quality education, offering them “different opportunities” to draw upon their multiple intelligences is an excellent way to ensure quality learning.

Implementation of Multiple Intelligence in Science Classes

- Science is best learned by doing science.
- The best memories are the ones that are made outside of a desk, and we are losing focus on improving students as a whole.
- By utilizing and understanding MI theory, we are restoring those valuable moments of childhood that come with developing the whole range of intelligences outside of a traditional school setting.

Logical/Mathematical Intelligence

Implementation of
MI
in Science Classes



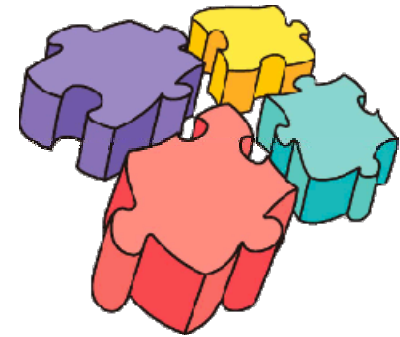
“Number/Reasoning Smart”

- Explaining subjects in a logical order - From simple to more complex
- Explaining subjects by drawing concept maps, flow charts, graphs – These are also valid for visual intelligence
- Making data analysis
- Problem solving
- Conducting experiments to demonstrate science concepts.
- Designing alphabetic and numeric codes.

Visual/Spatial Intelligence

Implementation of
MI
in Science Classes

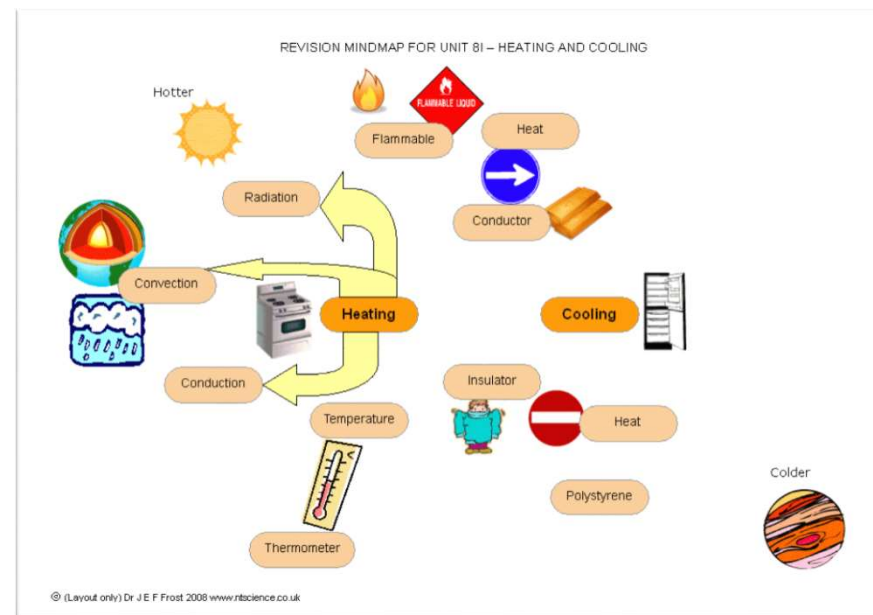
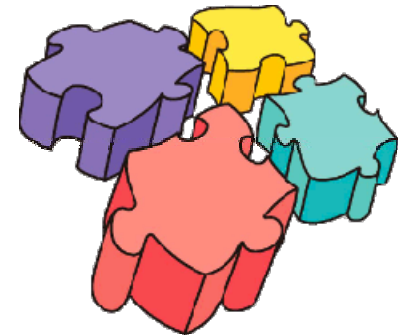
“Picture Smart”



- Using graphic organizers, pictorial models such as flow charts, visual maps, Venn diagrams, and timelines to connect new material to known information.
- Writing some equations inside a triangle to make equations visual
- Drawing pictures, figures on cardboards and making posters.
- Using real models, posters
- Using powerpoint presentations
- Using videos and flash animations for content-area topics
- Drawing figures using computer software programs such as Paintbrush, Powerpoint, Word, Excel, Mindmanager
- Using clay or play dough to make objects or represent concepts from content-area lessons.
- Taking photographs for assignments and classroom newsletters.
- Using cartoons while explaining content-area

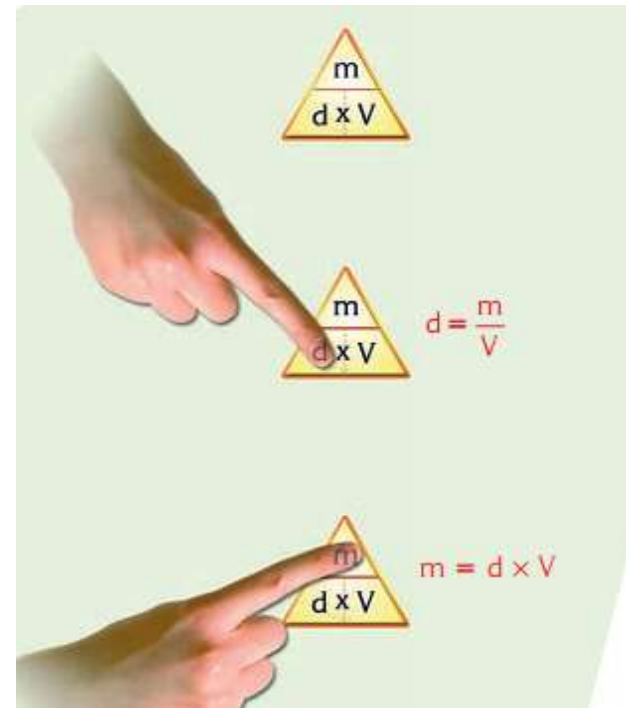
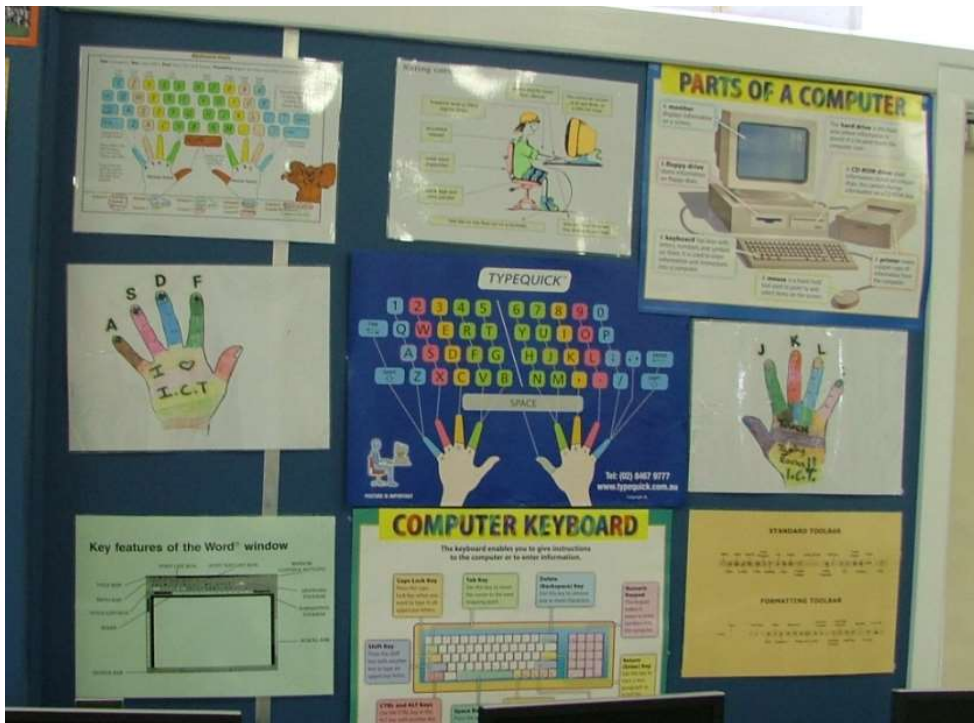
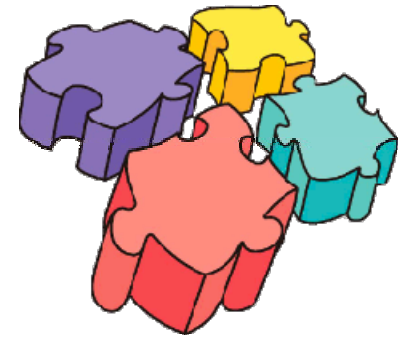
Visual/Spatial Intelligence

Implementation of MI in Science Classes "Picture Smart"



Visual/Spatial Intelligence

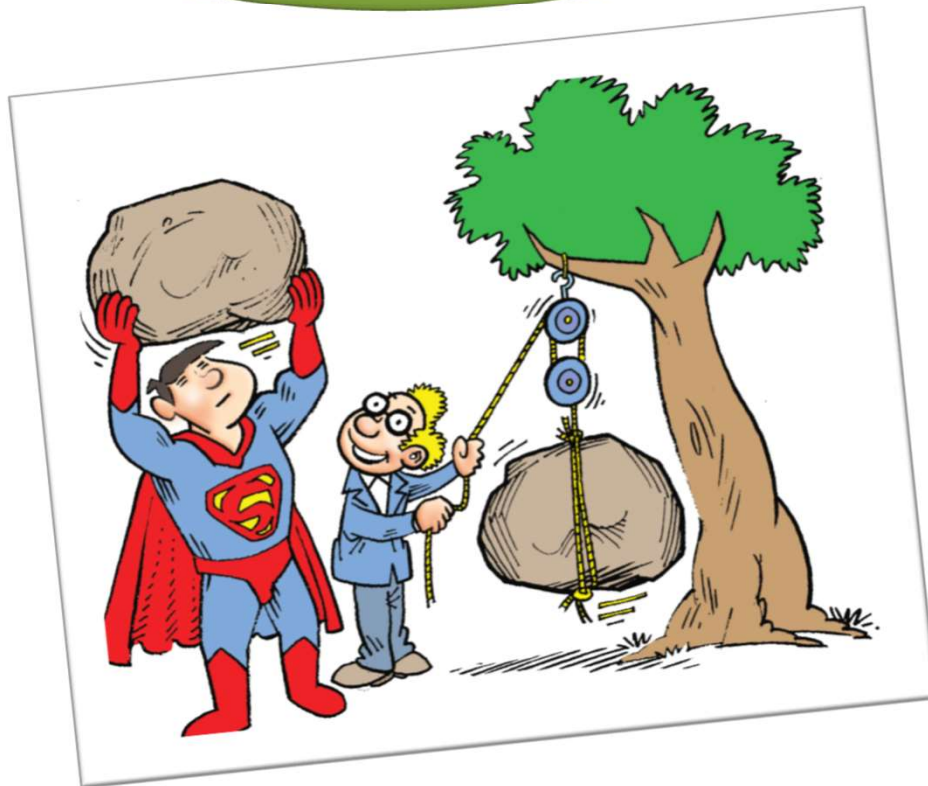
Implementation of
MI
in Science Classes
"Picture Smart"



Visual/Spatial Intelligence

Implementation of
MI
in Science Classes

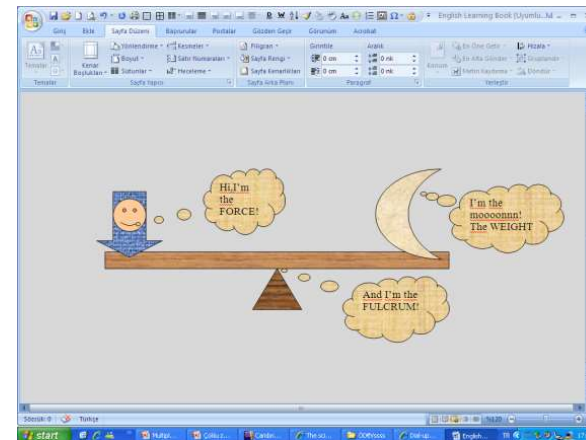
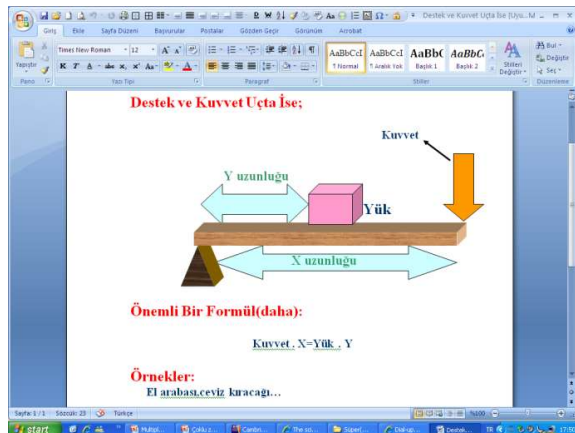
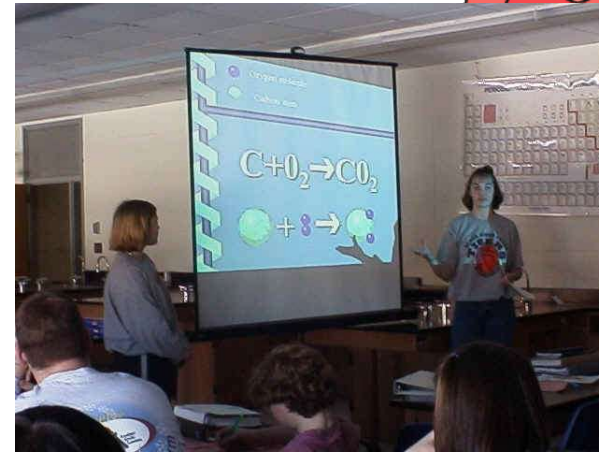
“Picture Smart”



Visual/Spatial Intelligence

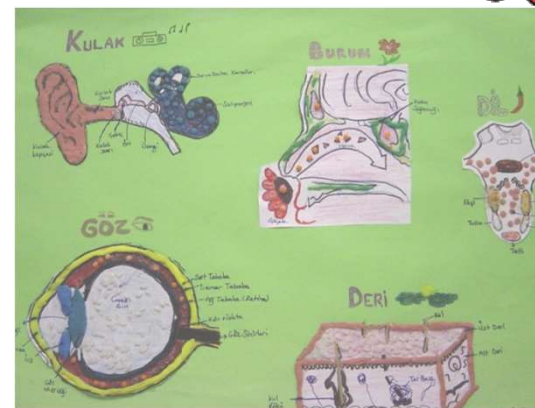
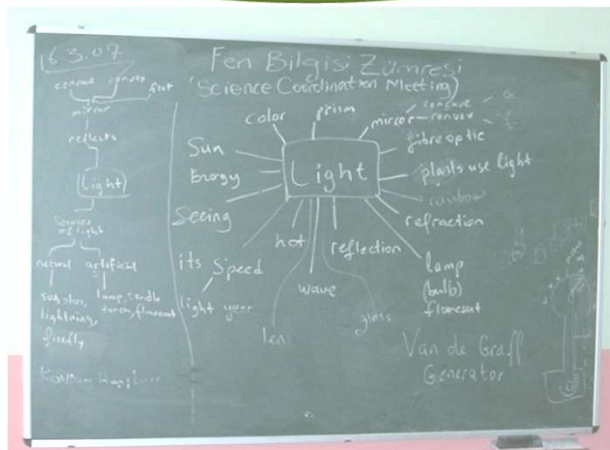
Implementation of MI in Science Classes

“Picture Smart”



Visual/Spatial Intelligence

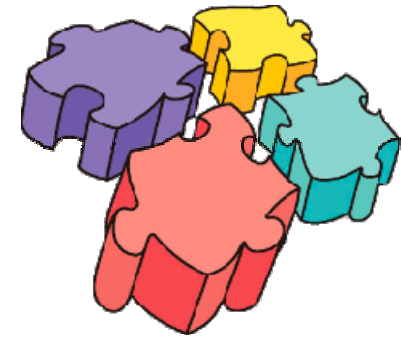
Implementation of
MI
in Science Classes
“Picture Smart”



Visual/Spatial Intelligence

Implementation of
MI
in Science Classes

“Picture Smart”



Bodily/Kinesthetic Intelligence

Implementation of
MI
in Science Classes

“Body Smart”



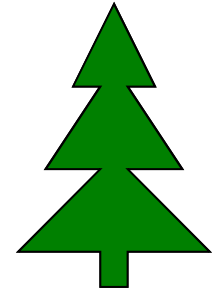
- Role play, Drama, sketch (eg. Molecules, transform from ice to water to gas physically in the room...)
- Acting out concepts. For example, for the solar system, "student planets" circle around a "student sun."



Naturalist Intelligence

Implementation of
MI
in Science Classes

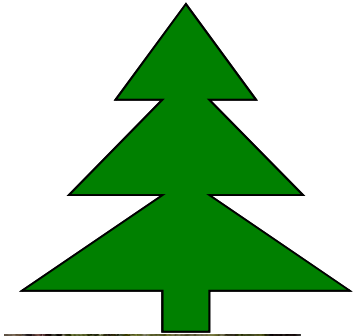
“Nature Smart”



- Caring for environmental problems. Eg. Global warming up, environmental pollution
- Caring for classroom plants.
- Caring for classroom pets.
- Sorting and classifying natural objects, such as leaves and rocks, seeds
- Researching animal habitats.
- Observing natural surroundings. Excursions, field trips
- Organizing or participating in park/playground clean-ups, recycling drives, and beautification projects.

Naturalist Intelligence

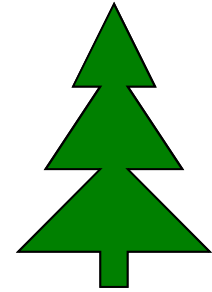
"Nature Smart"



Naturalist Intelligence

Implementation of
MI
in Science Classes

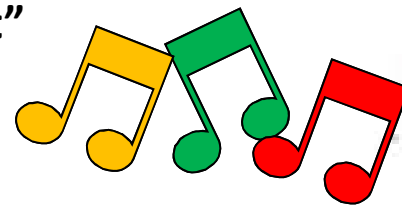
“Nature Smart”



Musical/Rhythmic Intelligence

Implementation of MI in Science Classes

"Music Smart"



- Using videos for content-area topics
- Using original animal sounds.
- Performing some equations or cause relation effects with melody.
- Writing songs and music about content-area topics.
- Putting original poems to music, and then performing them for the class.
- Setting a poem to music, and then performing it for the class.
- Incorporating a poem they have written with a melody they already know.
- Tape recording a poem over "appropriate" background music (i.e., soft music if describing a kitten, loud music if they are mad about pollution).
- Using rhythm and clapping to memorize math facts and other content-area information. (Ex: $v = x \cdot t$ – by clapping)

Intrapersonal Intelligence

Implementation of MI in Science Classes



“Self Smart”

- We want the student to think about himself/ herself as an element, a plant, a simple machine or an organ. Then we want him or her to explain his or her duties.
- Think about which organ is the most important?
- Which element is the most useful? If you would be an element, which element will you prefer to be?
- Writing reflective papers on content-area topics.
- Writing essays from the perspective of living things. Example: A tree to be cut after a short time.
- Writing goals for the future and planning ways to achieve them.
- We want him or her to think that he or her was a branch of a tree. After a while the branch turned into a piece of coal. We ask him or her which phases he or her passed.
- Using software that allows them to work alone and preparing slays about the content-area.

Interpersonal Intelligence

Implementation of
MI
in Science Classes

“People Smart”



- Working in cooperative groups to design and complete projects.
- Working in pairs to learn science facts.
- Interviewing people with knowledge about content-area topics (such as a lab technician to learn about life science).
- Tutoring younger students or classmates.
- Using puppets to put on a puppet show

Interpersonal Intelligence

“People Smart”



Verbal-Linguistic Intelligence

Implementation of MI in Science Classes

“Word Smart”



- Writing an equation like a tongue twister. Example: $d = m/V$ monkey donkey Valley ($m=dV$)
- ACRONYM, an abbreviation consisting of the first letters of each word in the name of something, pronounced as a word. Example: Colors of rainbow: ROYGBIV
- Example: Planets – MVEMJSUN – My Very Excellent Mom Just Served Us Noodles
- Writing the elements in the periodic table like a tongue twister.

Verbal-Linguistic Intelligence

“Word Smart”

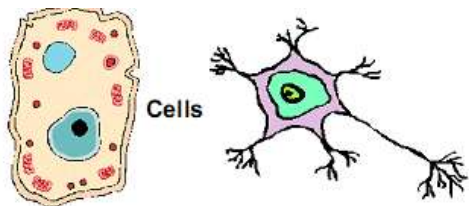


- Playing games like Scrabble.
- Listening to a storyteller.
- Writing short stories for content-area subject.
- Writing feature articles for the school newspaper.
- Using digital resources such as electronic libraries, desktop publishing, word games, and word processing.
- Creating poems about the content-area subject.
- Completing crossword puzzles with vocabulary words.
- Writing a story about a science subject: Example: That day I was in a glass bottle. But it was a so hot day. They put me inside the cooling unit of fridge to become cold water. Then I get cooler cooler. But they forgot me and then I turned into solid. Do you know what happend after that?

Verbal-Linguistic Intelligence

Implementation of MI in Science Classes

"Word Smart"



Cells



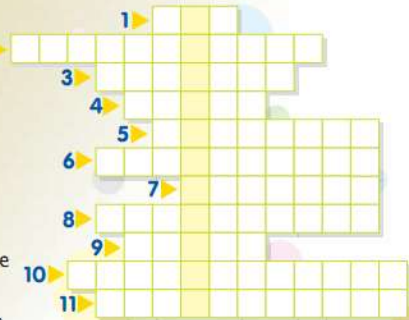
T L F O D O O L B E Z E T E Y
T U B I R R A E N O R U E N C
S M D A U E S U E L C U N Y Y
C T L L T R E B A L S Y E D T
E T H O I S E I P O C T D T O
L O T E L C N S S T S I C P
O L U X A O A L C P L A V O L
U A O L I L R L S E E L I N A
C C R L L E B E A C R P D T S
A A G E E U M C N E A O V R M
V T A C H S E E O L Z R L O E
L A N E T S M L E L A O O L U
R C H Z I I W A L L N L E P P
I U N L P T E K M R O H B O R
L A P N E N B U C A O C H L J



PUZZLE

Find the word in the coloured column. It is the name of the instrument which is used to measure heat changes.

1. Solid state of water
2. Change in state from solid to gas
3. The moment at which vaporisation is at its maximum rate
4. A mass of condensed water vapour in the sky.
5. Change in state from liquid to solid
6. A liquid which prevents car motors from freezing
7. Transforming into a liquid by heating
8. Hidden heat
9. A type of matter which is densest at +4 celsius degree
10. A change in state from gas to liquid
11. An instrument which measures temperature change



Verbal-Linguistic Intelligence

Implementation of
MI
in Science Classes

“Word Smart”



- **Atom**

I am the tiniest structure
building blocks of every matter
I have a nucleus at the center
There are protons and neutrons
And electrons revolving around
The proton and electron has a charge
But the neutron has no

Verbal-Linguistic Intelligence

Implementation of
MI
in Science Classes

“Word Smart”



- **Fading away**
the trees that allow us to live- we kill
the planet which is our home- we
destroy
the water which we drink- we pollute
Is this our destiny?

Verbal-Linguistic Intelligence

Implementation of
MI
in Science Classes



“Word Smart”

- **Planting tree**
- The green branches above
once but a small young tree
I planted it and watched it grow
now so much larger than I
it is like a child
living here, just like I do
I treat it as an old friend
whom I have spent many years
and in the end, when I am gone
perhaps it will still stand
but I will always recall
the time spent with this tree
once small



Summary

- We described “Intelligence” and “the theory of multiple intelligence.”
- We talked about why we have to use different methods to teach science.
- We looked at the the types of intelligences.
- We discuused have we implement MI theory in science clases by examples.

Some Points to remember

- Gardner says that there are more than eight intelligences, such as existentialist intelligence.
- Intelligences usually work together in complex ways.
- Most people can develop each intelligence to an adequate level of competency.
- The rich diversity of ways in which people show their gifts *within intelligences as well as between* Intelligences.

Study Questions

1. What are the traditional types of intelligences?
2. How many types of intelligences Gardner offered? Name them.
3. Does every body have the all types of intelligences or not? Explain.
4. How can you implement the multiple intelligence in physics teaching? Give examples at least for four different intelligences.
5. Why it is important to use multiple intelligence theory in teaching physics?

• References

- Intelligence Reframed: Multiple Intelligences for the 21st Century by Howard Gardner
- Shen, K., (1993). Happy Chemical Education, J. Chem. Edu., 70, 816-818.
- Multiple Intelligences in the Classroom, May 2000, Part I: Assessment of "Intellectual Profiles" by Lisa Chipongian
- Sevilay KARAMUSTAFAOĞLU Assist.Prof.Dr., Amasya University, Education Faculty, Primary Science Education, Amasya