

Learning Chemistry via Multiple intelligences

Gloria Brown Wright
Department of Chemistry
The University of Texas
Austin, Texas

Introduction

- Traditionally chemistry is taught verbally with a strong mathematical bias
- Many of today's chemistry students mathematically and linguistically challenged
- Traditionally such persons viewed as being of low intelligence

Alternative view proposed by Howard Gardner:

- There are nine intelligences which everyone possesses to varying extents
- Specific disciplines are facilitated by specific intelligences
- One's intelligence strengths can function as a 'window' for introducing a discipline that is supported by intelligences that are present only weakly disciplines

The Multiple Intelligences: criteria

- Isolation as a brain function
- Prodigies, idiots savants, exceptional individuals
- Set of core operation
- Developmental history with an expert end performance
- Coincidence with cultural evolutionary view of human development
- Supported psychological tasks
- Supported psychometric tasks
- Encoded into a symbol system

The Multiple Intelligences: Identities and Characteristic Learning Modes

- Existentialist: ability to make links to the 'big picture', the meaning, purpose of life
- Intrapersonal: self-knowledge and the ability to act adaptively on the basis of that knowledge
- Interpersonal: ability to perceive and make distinctions in the moods, intentions, motivations, feelings of others
- Kinesthetic: expertise in using whole body to express ideas and feelings; facility in using hands to produce or transform things

- **Linguistic:** capacity to use words effectively, orally or in writing
- **Logical-mathematical:** the capacity to use numbers effectively and to reason well
- **Musical:** the capacity to perceive, discriminate, transform, and express musical forms
- **Naturalist:** ability to identify, organize and categorize
- **Spatial:** ability to perceive the world accurately and to perform transformations upon one's perceptions

MULTIPLE INTELLIGENCE THEORY OF GREATEST INTEREST TO EDUCATORS

Documented Multiple Intelligence Experiments

- Most done at the elementary level
- Some at middle school level
- Few in high schools
- Very little at tertiary level

- Very few involve science
- One at high school level involving chemistry

- Lack of published research on learning chemistry via multiple intelligences

Dorothy Gabel (JChemEd, April 1999):

- Chemistry education research has so far had little impact on the way chemistry is taught
- In the new century classrooms will be more diversified, international and heterogeneous in terms of students' background, abilities and range of intelligences.
- Computers will play a more significant role.

The proposed research will investigate what relationships (if any) exist between one's multiple intelligences and the learning of college Chemistry?

Current Pilot Project

- Purpose: to develop a final chemistry instrument for undergraduate
- Involves graduate students in chemistry
- Three sections: chemistry instrument, interview, MIDAS

Results of Pilot Project

- OVERALLTREND (28 subjects):
linguistic>logical-mathematical>
spatial
- Analytical (11 subjects):
linguistic>logical-mathematical>
spatial
- Biochemical (4 subjects):
linguistic>spatial>logical-
mathematical

(continued)

- Chemical education (4 subjects): linguistic>logical-mathematical=spatial
- Inorganic (1 subject): logical-mathematical>linguistic>spatial
- Organic (4 subjects): linguistic>spatial=logical-mathematical
- Physical (4 subjects): linguistic>logical-mathematical>spatial

Some reasons given for choice of format:

- That's how I learnt it
- That's how I usually teach it
- That's how I think/think of it
- It shows/states it clearly

Some reasons given for rejecting format:

- It didn't make sense
- It took too long to decipher
- I never saw this/something like this before
- There was too much to read/decipher/go through

Results of one life-science graduate:

- OVERALL: linguistic>spatial>logical-mathematical
- Linguistic explanations in general are clear and understandable statements
- Logical-mathematical explanations are less understandable or undecipherable

THE PROPOSED EXPERIMENT

- THE QUESTION: What effect does the presentation of chemistry concepts to accommodate students' multiple intelligences have on their learning of chemistry?

Procedure

- Three groups of students in first-year chemistry
- Three chemistry concepts to be presented
- Three intelligences (linguistic, logical-mathematical, spatial) to be involved
- Vehicle will be the web-based course developed by Dr. Lagowski and Brian Arneson

Data To Be Collected

- Assessment of knowledge of concept done before (pre-test), immediately after (flasj quiz) and some time after (post-test) instruction
- MIDAS to be administered to students in each group
- MIDAS and chemistry assessment results to be examined for evidence of correlation

CONCLUSION

- This research, hopefully, contribute to the quest for more effective learning of chemistry, and
- provide experimental data that sheds light of the merits or demerits of Gardner's theory