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TOWARDS IMPROVING CHEMISTRY TEACHING AND LEARNING: THE INFLUENCE OF LEARNING STYLES

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The first year chemistry program comprises of four courses: two courses offered in the first semester and another two in the second semester. The courses are offered to students majoring in various science-based fields such as Chemistry, Education and Industrial Technology. An analysis of the grades obtained showed that students' performance in these courses was not encouraging as indicated by the high failure rates and most students were still struggling with the basic chemistry concepts. The inadequacy of students' knowledge of chemistry and the resulting learning difficulties has been a major concern to the educators. A number of studies have proposed that teaching would be more effective if faculty members took account of differences in students' learning styles, which can positively or negatively influence a student's performance. Knowledge and understanding of students' learning styles or preferences is also the key to getting students to be actively involved in the learning process. Research findings suggest that students who are actively engaged in the learning process will be more likely to achieve. Therefore it would be wise to understand what the students' learning style preferences are, and how to address them when preparing instructional materials. This paper will present the findings from a survey involving students who were registered for one of the first year chemistry courses. The aim of the survey was to identity students' preferred learning style and to determine if there is any correlation between students' learning style and their performance in chemistry. Felder's Learning Style Inventory was used to measure the students' preferred learning styles and their achievement was measured by the overall grade obtained at the end of the semester.

Towards improving chemistry teaching and learning: the influence of learning styles

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Purpose of study

- To identify learning styles of students in first year Analytical Chemistry course.
- To identify correlation between learning styles and performance.

Learning styles

- How an individual acquires and processes information.
- Students focus on different types of information according to their preference
- Tend to work on perceived information in different ways.
- Achieve understanding at different rates.

Compatible learning-teaching styles

- Students tend to retain information longer.
- Apply information more effectively.
- More positive attitudes towards cour

Sample

- Undergraduates in first year Analytical Chemistry course (346)
  - Chemistry majors /minors
  - Education majors (major/minor in Chemistry)
  - Other Science based majors

Analytical Chemistry

- Quantitative analysis based on various kinds of titrations
  - Understand chemical reaction used as basis for titrations
  - Perform necessary calculations
  - Practical applications of titrations

Methodology

- Questionaire based on Index of Learning Styles, an instrument developed by B.A. Soloman and R.M. Felder.
- To assess preferences of a learning style model by Felder and Silverman.
- 44 items questionaire

Four dimensions of learning style model

- Active / Reflective learners
- Sensing / Intuitive learners
- Visual / Verbal learners
- Sequential / Global learners

Active / Reflective learners

- How does the student prefer to process information?
  - Active
    - Learn while doing something actively
    - Prefer to work in groups
  - Reflective
    - Thinking things out before trying it out
    - Prefer to work in pairs/ alone

Sensing / Intuitive learners

- What kind of information does the student prefer to receive?
  - Sensing
    - Likes facts and observations
    - Likes solving problems; doesn't mind detail work
  - Intuitive
    - Imaginative; likes variety in their work
    - Bored with too much detail and repetition

Visual / Verbal learners

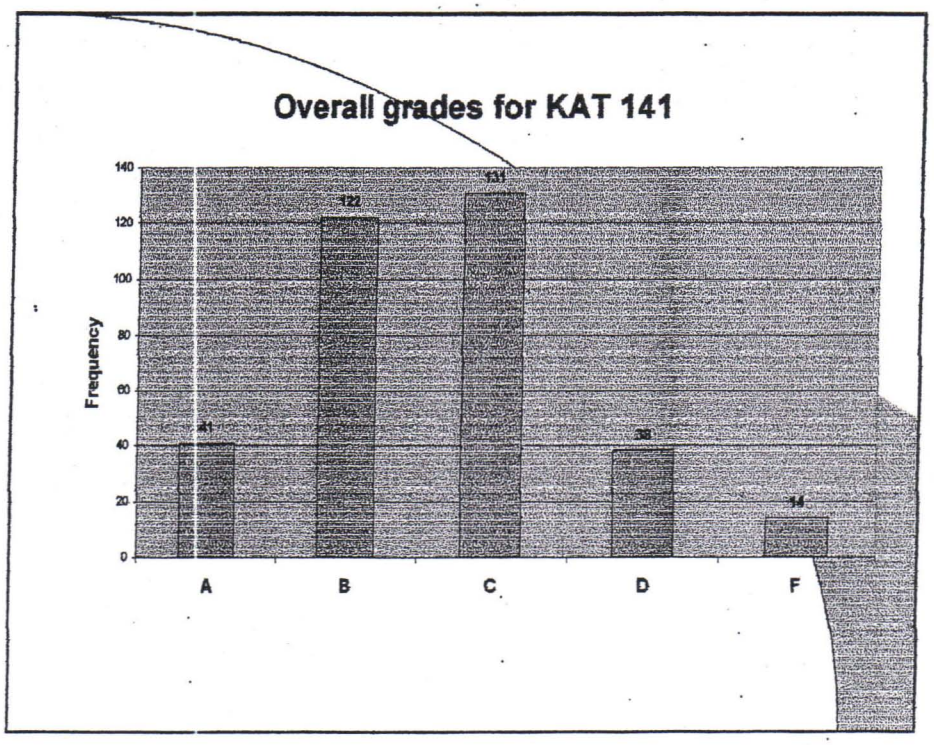
- How is the information most effectively perceived?
  - Visual
    - Get more information from pictures, diagrams, graphs, demos
  - Verbal
    - More information from written and spoken words, mathematical formulas

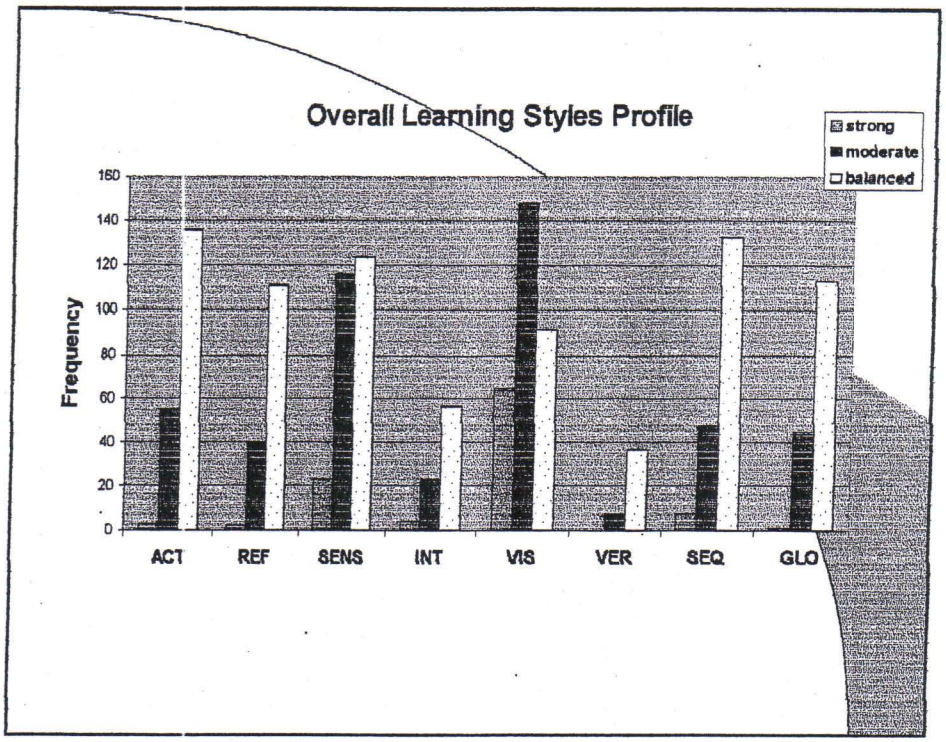
Sequential / Global learners

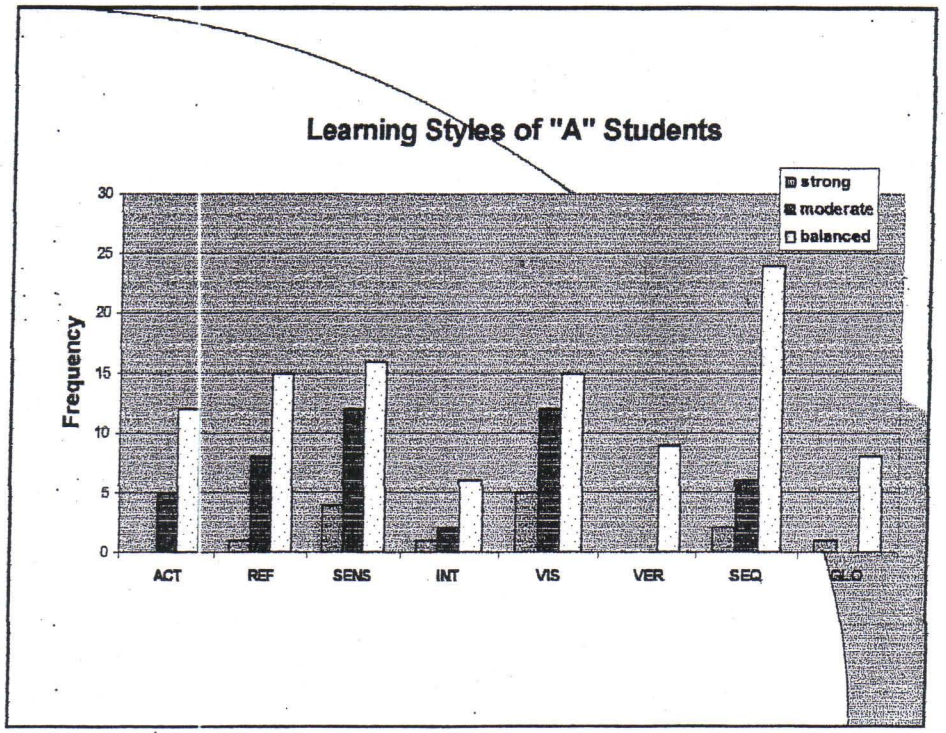
- How is understanding achieved?
  - Sequential
    - Absorb information and acquire understanding in small chunks
    - Lack grasp of whole picture
  - Global
    - Take in information in unconnected fragments
    - Understand in large leaps

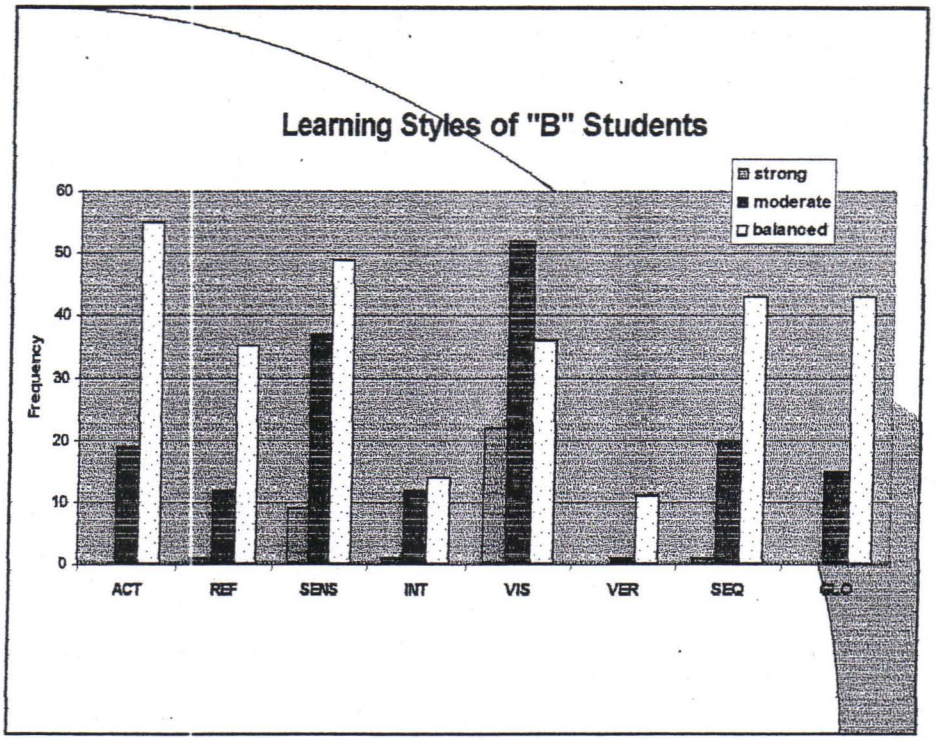
Traditional lectures

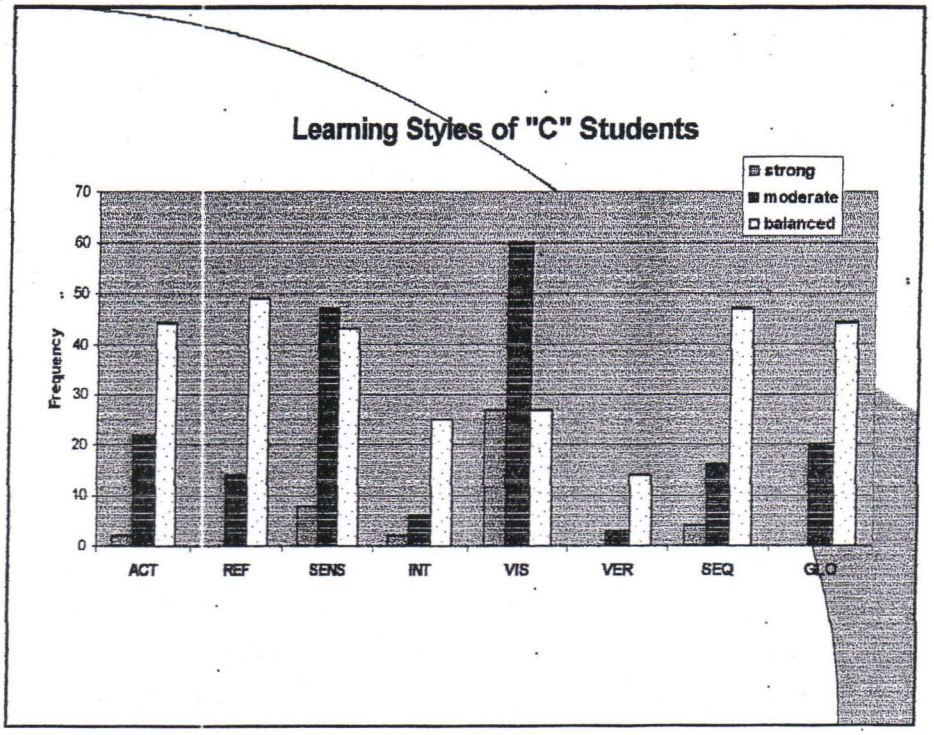
- Very verbal – written, formulas, spoken words
- Occasional diagram, charts or demos
- Targeted towards intuitive, verbal, reflective, sequential learners
- Labs for sensory, visual, active learners
- No labs associated 1:1 with lectures




Overall Learning Styles Profile
strong
moderate
balanced
Frequency
160
140
120
100
80
60
40
20
0
ACT
REF
SENS
INT
VIS
VER
SEQ
GLO


Learning Styles of "A" Students
strong
moderate
balanced
Frequency
30
25
20
15
10
5
0
ACT
REF
SENS
INT
VIS
VER
SEQ
GLO


Learning Styles of "B" Students
strong
moderate
balanced
Frequency
60
50
40
30
20
10
0
ACT
REF
SENS
INT
VIS
VER
SEQ
GEO


Learning Styles of "C" Students
strong
moderate
balanced
Frequency
70
60
50
40
30
20
10
0
ACT
REF
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INT
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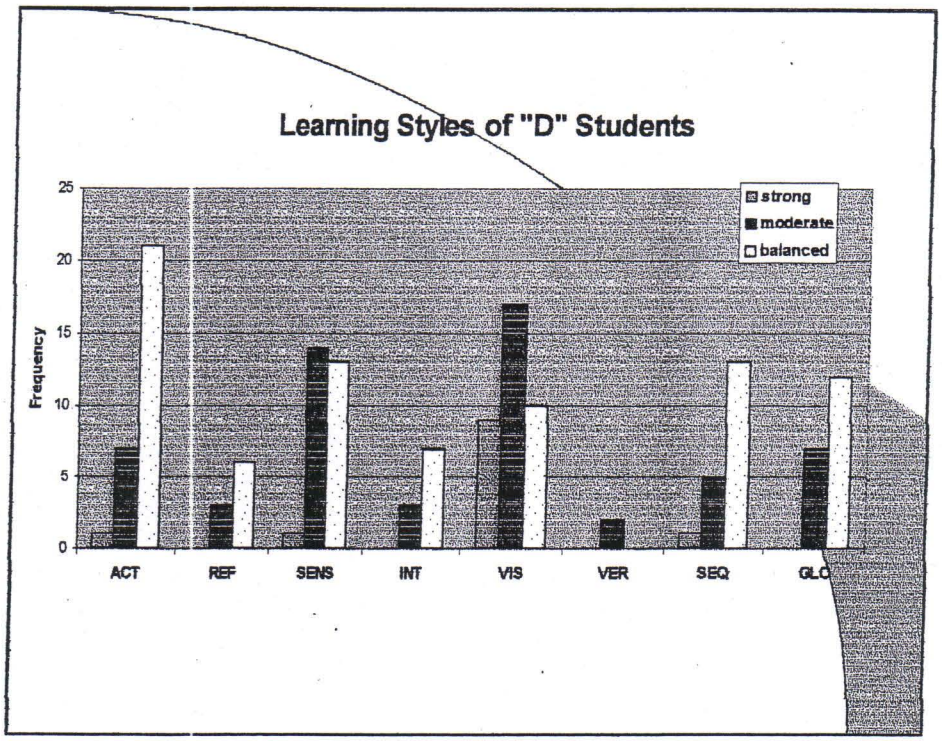
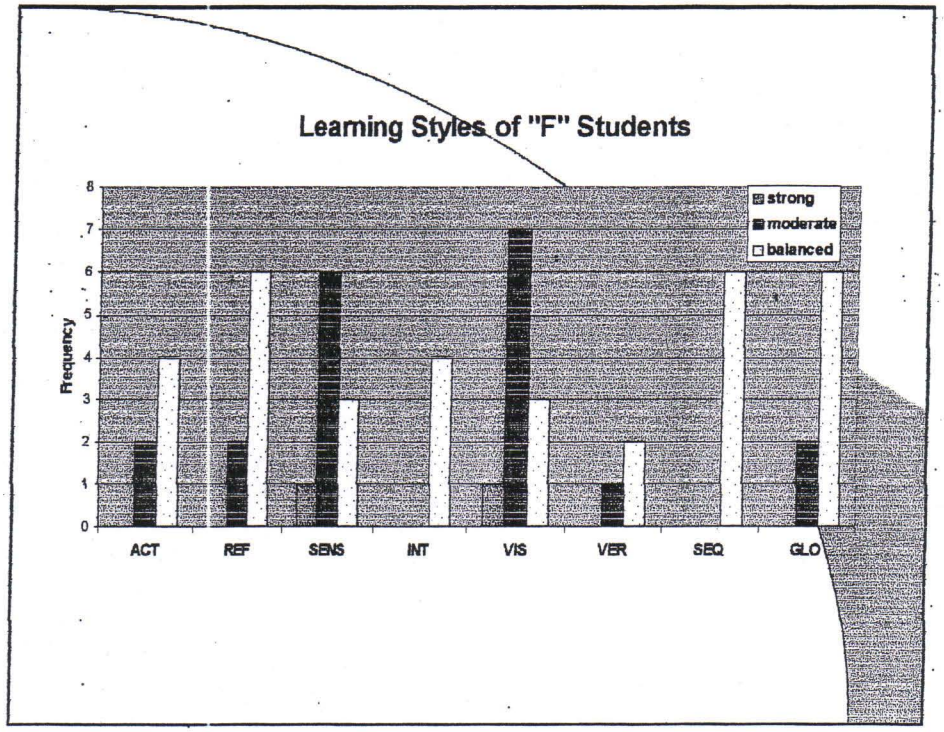
VER
SEQ
GEO


Learning Styles of "D" Students
strong
moderate
balanced
Frequency
25
20
15
10
5
0
ACT
REF
SENS
INT
VIS
VER
SEQ
GLO


Learning Styles of "F" Students
strong
moderate
balanced
Frequency
8
7
6
5
4
3
2
1
0
ACT
REF
SENS
INT
VIS
VER
SEQ
GLO

No correlation was found between learning styles and overall grade achieved by students.

Mismatches between teaching and learning styles in science courses

- Lower grades
- Less likely to develop interest in course material
- Loose interest in science altogether

Improvement in teaching styles

- Need to accommodate sensory, visual, active and global learners
- Motivate interest in science by establishing relevance to students' lives and personal interests – physical applications.
- Driving students to being active in the classroom
- Encourage cooperative learning with group projects
- Focus not only on algorithmic problem solving but also conceptual learning.
- Performing demos in class.
- Supplementary multimedia material available.

Teaching to accomodate all types of learning styles:

- *Improve students' learning*
- *Satisfaction with their instruction*
- *Develop students' self confidence*