

Toward a Mathematical Model of Teaching and Learning (M^2TL)

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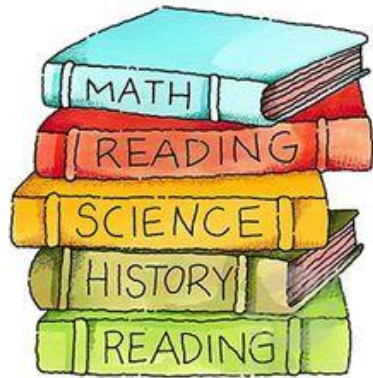
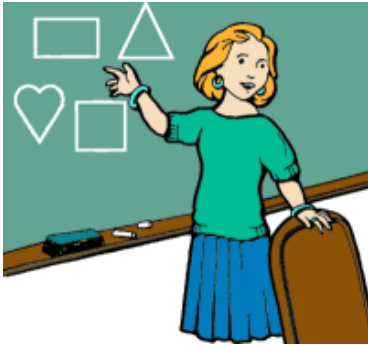
THE BIG QUESTIONS

What is the starting point in teaching?



How do teachers choose the best procedures in teaching?

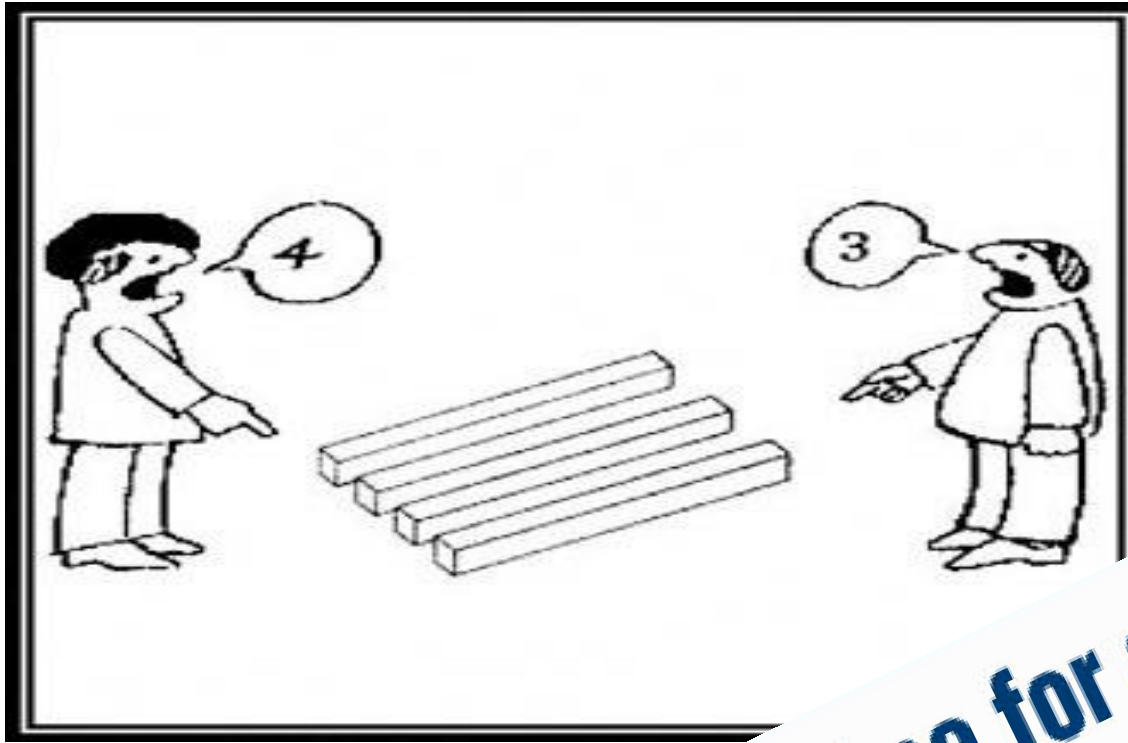
What is the most important factor (variable - element) that influence on the **teaching system**?



Is it possible to construct (or derive) **a specific rules** (or may be laws) between these factors(variables)?

The current paper aims to:

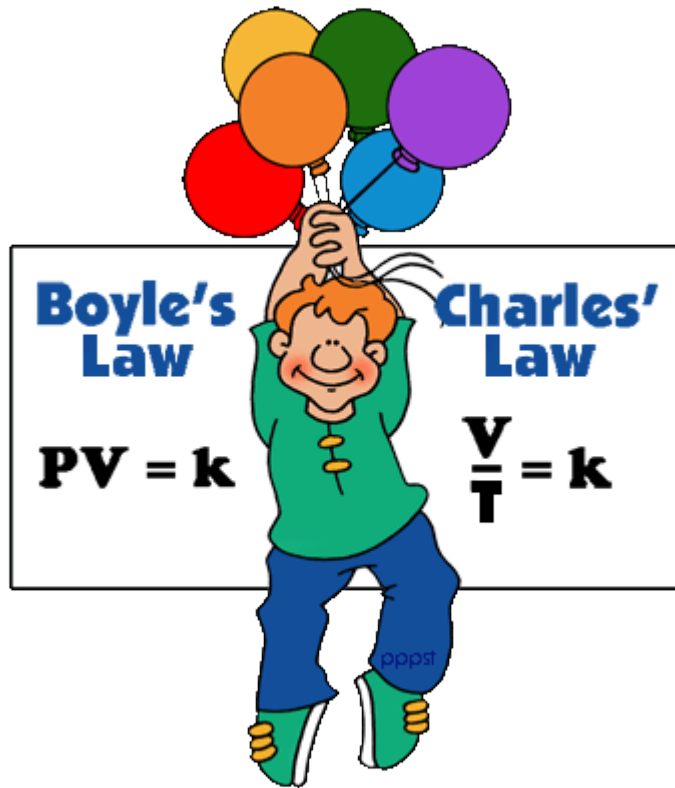
Introduce **a suggested perception** toward **transferring teaching processes from point of view to specific actions (procedures).**



Time for a Paradigm Shift?

How can we understand natural systems, Social systems,??

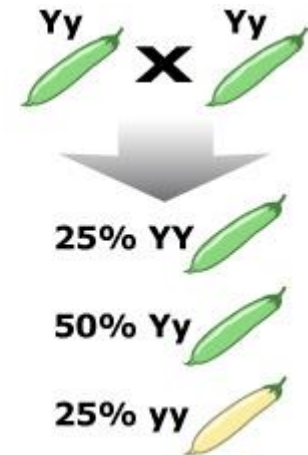
The answer is: **By Mathematical models.**



Gas System

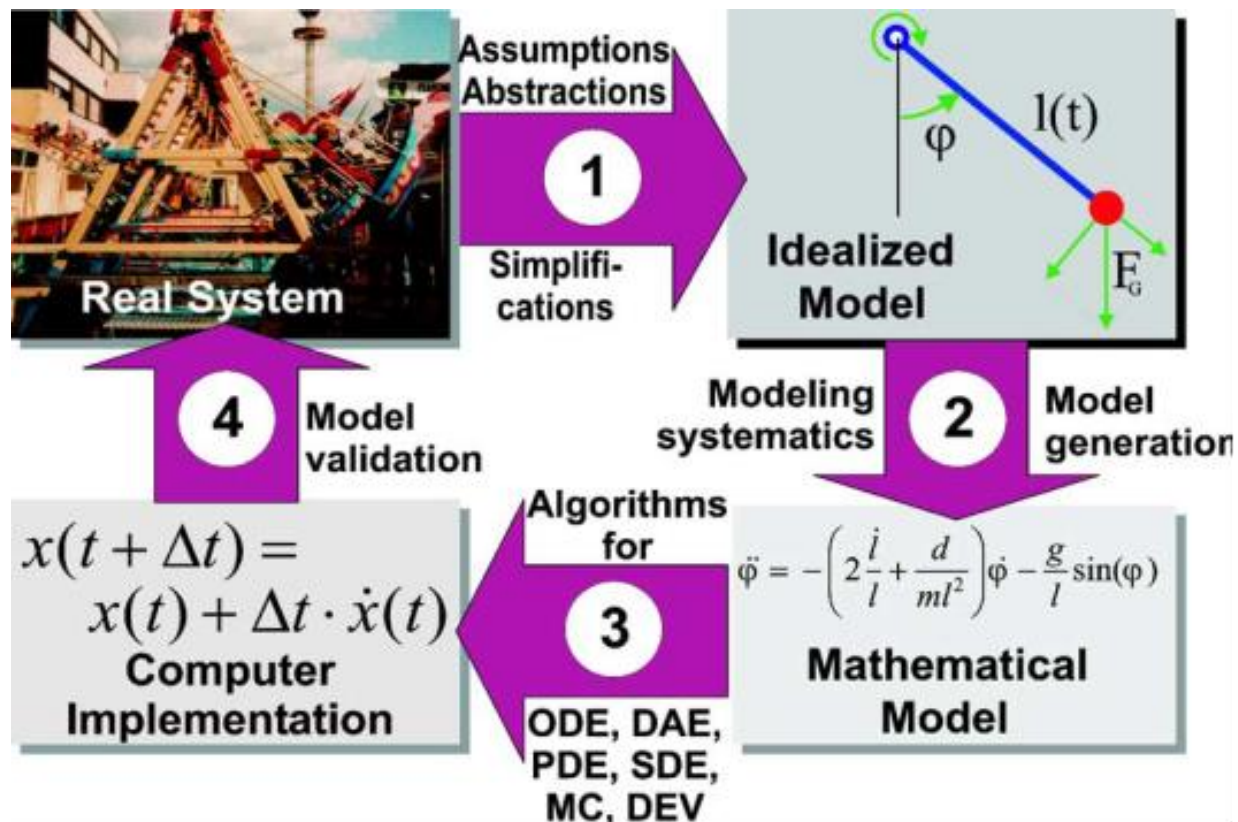


Mendelian Laws



A mathematical Model

is a description of a system (Real System) using mathematical language.



Postulates

- **Characteristics**

Teaching and Learning (TL) system is dynamic, continuous, and probabilistic, so these characteristics make it possible to construct such a mathematical model.

- **Math. Relation of TL System:**

$$TL \sim f(s, t, c, p, m, \dots)$$

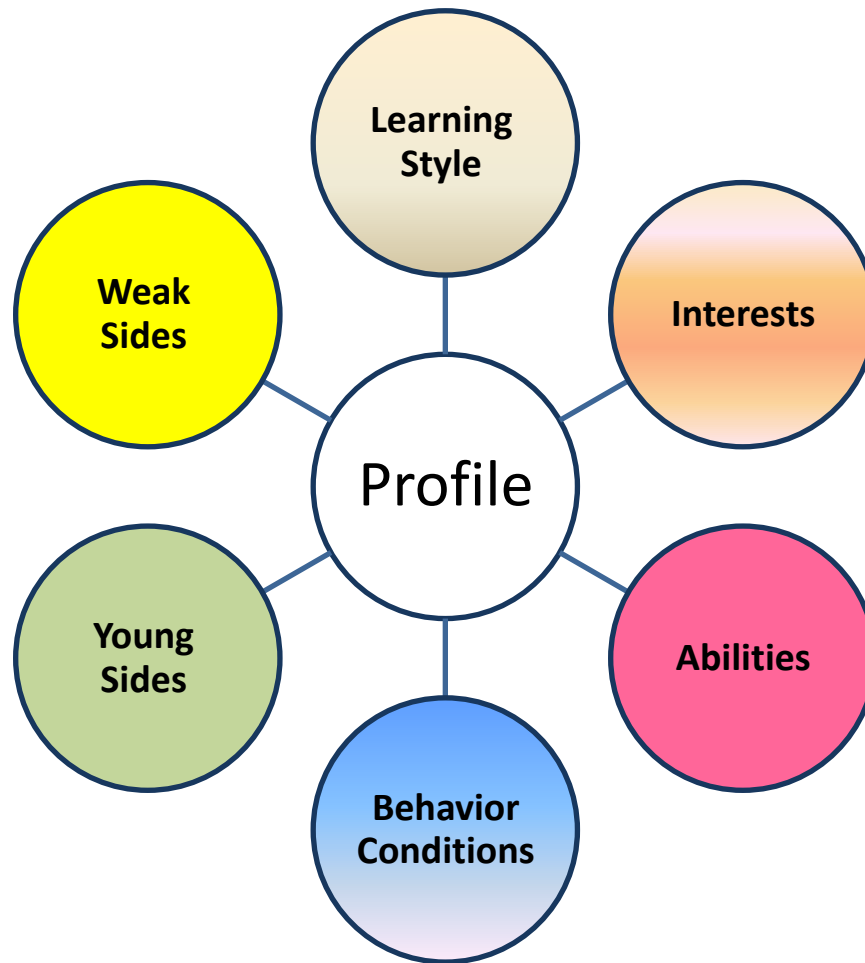
- **Mathematical tools:**

Math. Relations (Laws), Graphs.

- **Restrictions:**

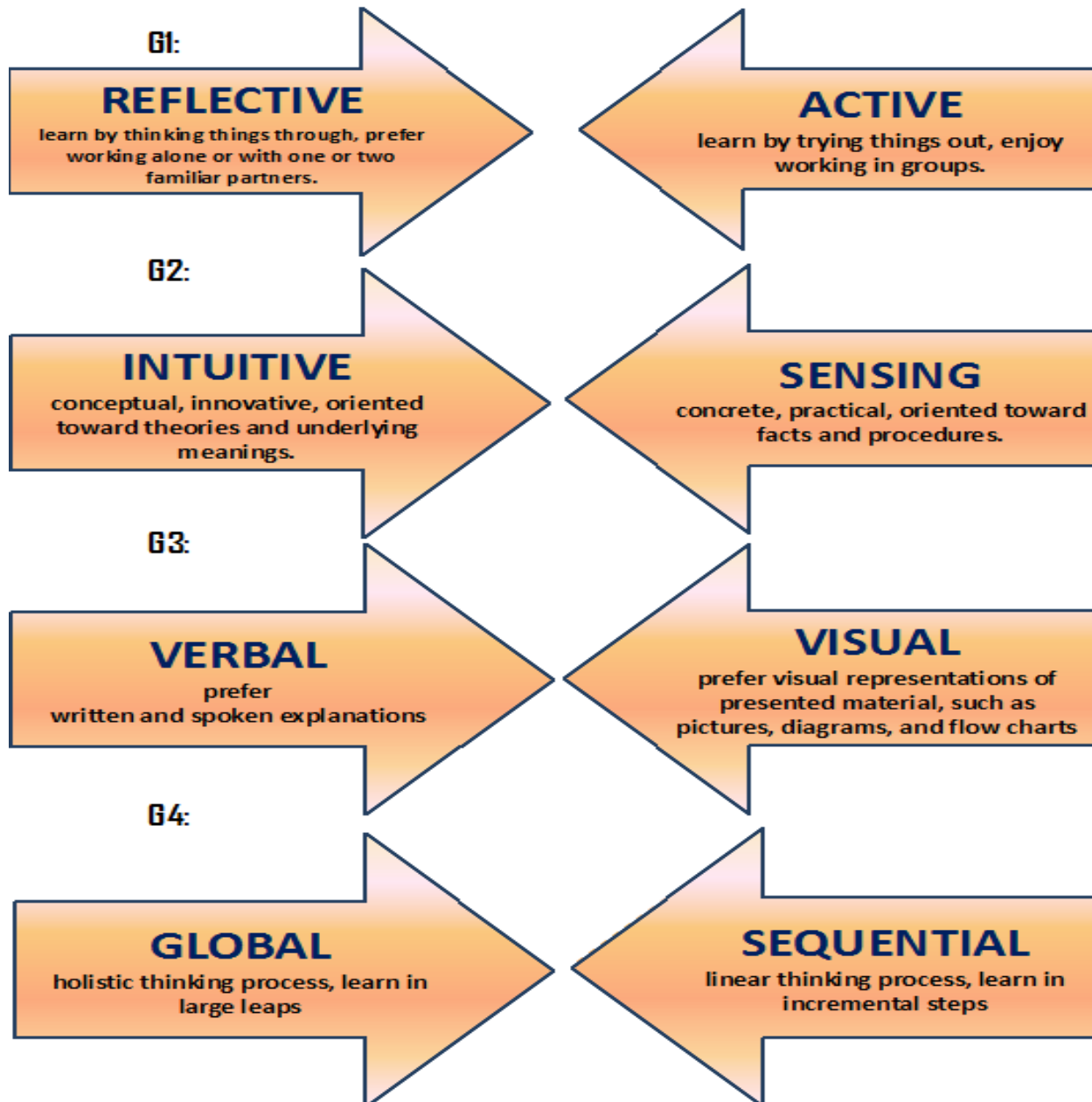
Constructing a mathematical model of the whole of TL system is ambitious but very difficult. So, it is better to start small with a very specific type of TL parameters.

We Begin with the Student!!



$\text{Profile} = \text{Ls} + \text{Is} + \text{As} + \text{BC} + \text{YS} + \text{WS}$

Felder-Silverman learning styles groups



A. Instrument

The ILS questionnaire consists of (44) items, that asks the respondent to choose one of two endings to a sentence that focuses on some aspect of learning in (4) scales (or dimensions). Each scale is related to (11) items, so the items (1,5,9,13,17,21,25, 29, 33,37, 41) are related to (ACT/REF) scale, (2,6,10,14,18,22,26,30,34,38,42) are related to (SEN/INT) scale, (3,7,11,15,19,23,27,31,35,39,43) are related to (VIS/VER) scale and (4,8,12,16,20,24,28,32,36,40,44) are related to (SEQ/GLO) scale. Scoring is 1, 3, 5, 7, 9, and 11, with 1 and 3 showing a balance along the continuum, 5 and 7 showing a moderate preference for one end of the continuum, and 9 and 11 a strong preference for one end or the other.

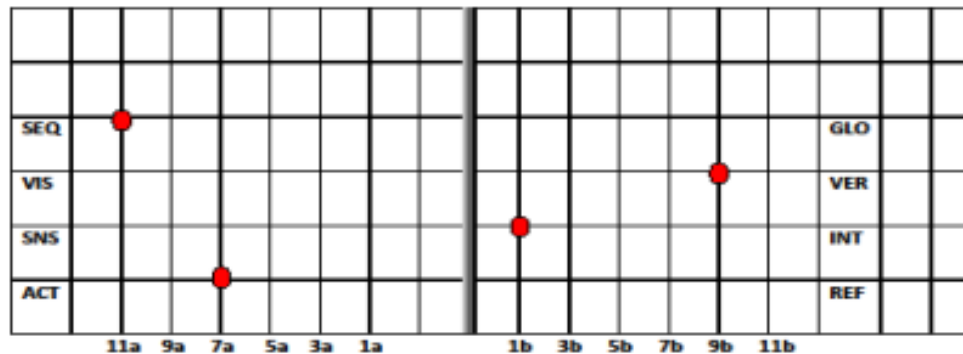
Examples of the Scale Items

Index of Learning Styles © 1996, North Carolina State University

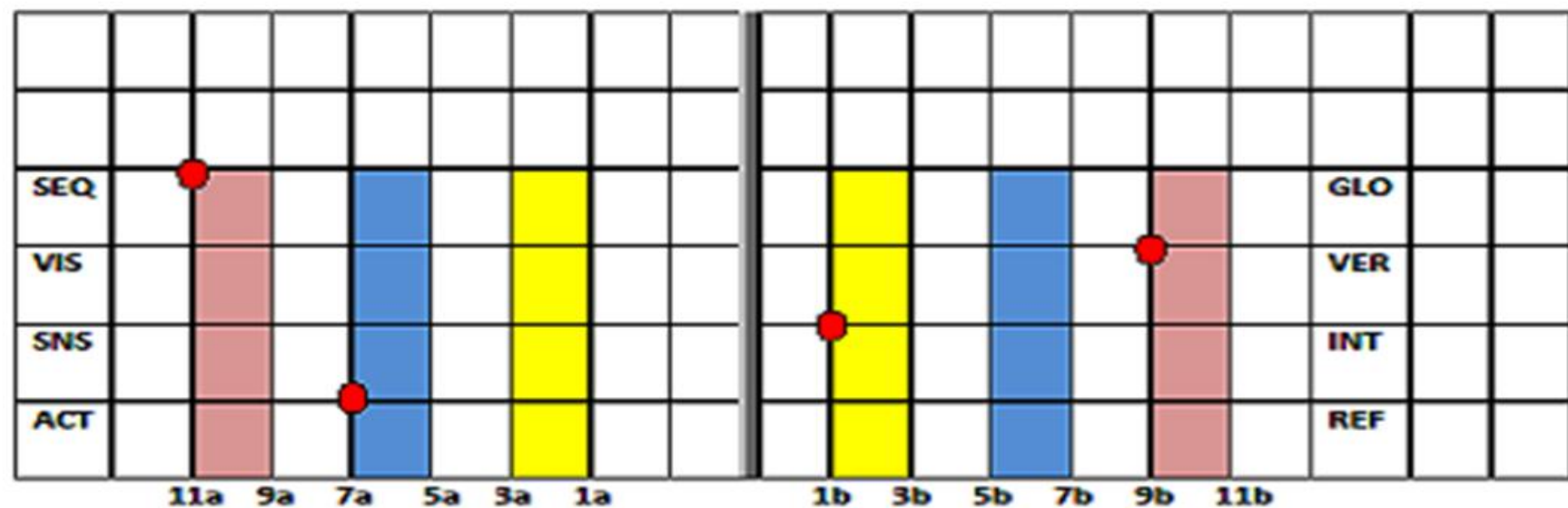
1. I understand something better after I
 - (a) try it out.
 - (b) think it through.
2. I would rather be considered
 - (a) realistic.
3. When I think about what I did yesterday, I am most likely to get
 - (a) a picture.
 - (b) words.
4. I tend to
 - (a) understand details of a subject but may be fuzzy about its overall structure.
 - (b) understand the overall structure but may be fuzzy about details.
5. When I am learning something new, it helps me to
 - (a) talk about it.
 - (b) think about it.
6. If I were a teacher, I would rather teach a course
 - (a) that deals with facts and real life situations.
 - (b) that deals with ideas and theories.
19. I remember best
 - (a) what I see.
 - (b) what I hear.
20. It is more important to me that an instructor
 - (a) lay out the material in clear sequential steps.
 - (b) give me an overall picture and relate the material to other subjects.
21. I prefer to study
 - (a) in a study group.
 - (b) alone.
22. I am more likely to be considered
 - (a) careful about the details of my work.
 - (b) creative about how to do my work.
23. When I get directions to a new place, I prefer
 - (a) a map.
 - (b) written instructions.

	ACT	REF		SNS	INT		VIS	VRB		SEQ	GLO
Q	a	b	Q	a	b	Q	a	b	Q	a	b
1	1		2		1	3		1	4	1	
5	1		6		1	7		1	8	1	
9	1		10	1		11		1	12	1	
13	1		14		1	15		1	16	1	
17		1	18	1		19		1	20	1	
21		1	22	1		23	1		24	1	
25	1		26		1	27		1	28	1	
29	1		30	1		31		1	32	1	
33	1		34	1		35		1	36	1	
37	1		38		1	39		1	40	1	
41	1		42		1	43		1	44	1	
SUM	9	2		5	6		1	10		11	0
(Larger – Smaller)+Letter of Larger											
	7a			1b			9b			11a	

Graph

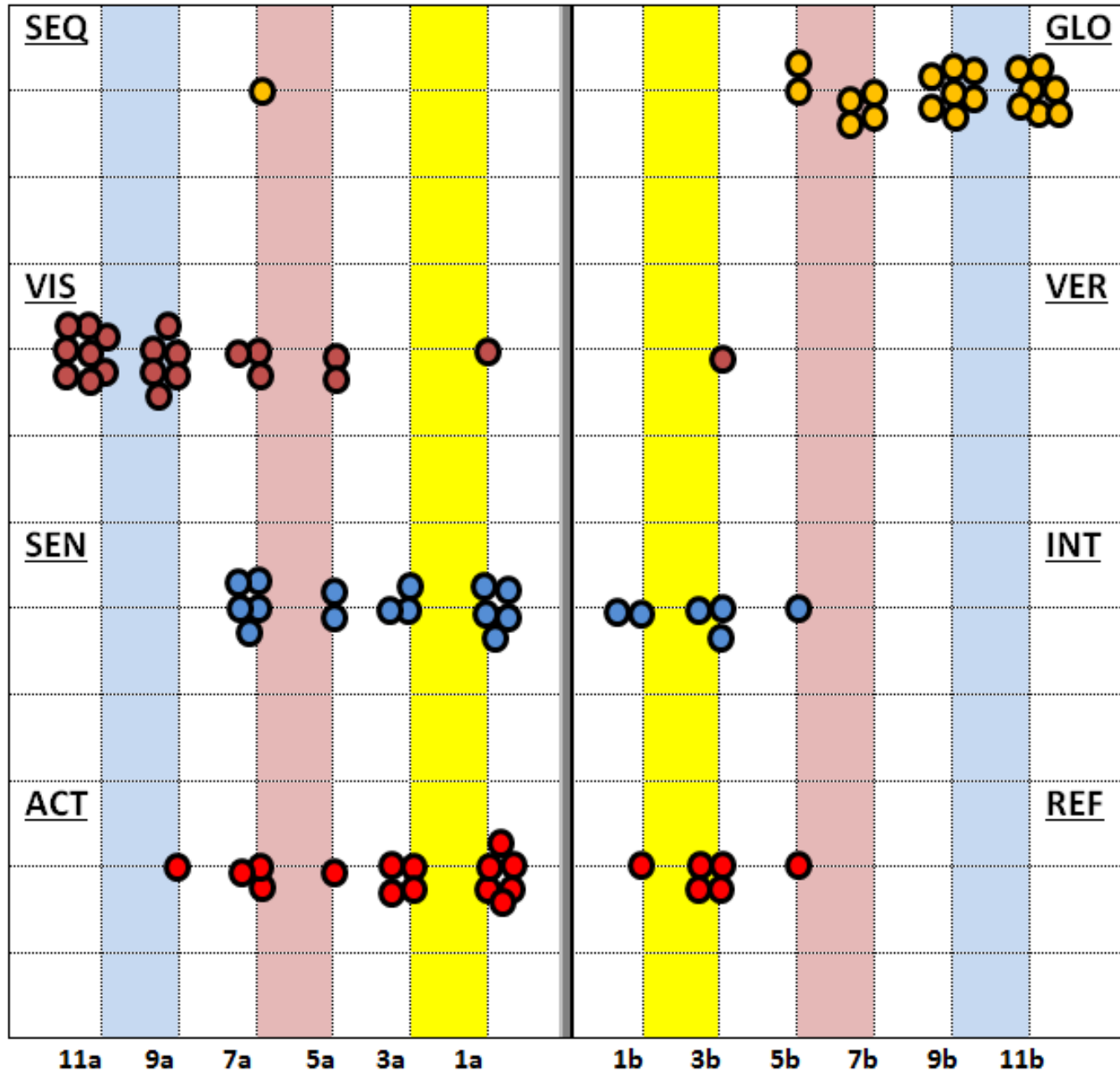


Graph



	1 - 3	fairly well balanced	متوازن
	5 - 7	moderate preference	تفضيل معتدل
	9 - 11	strong preference	تفضيل قوي

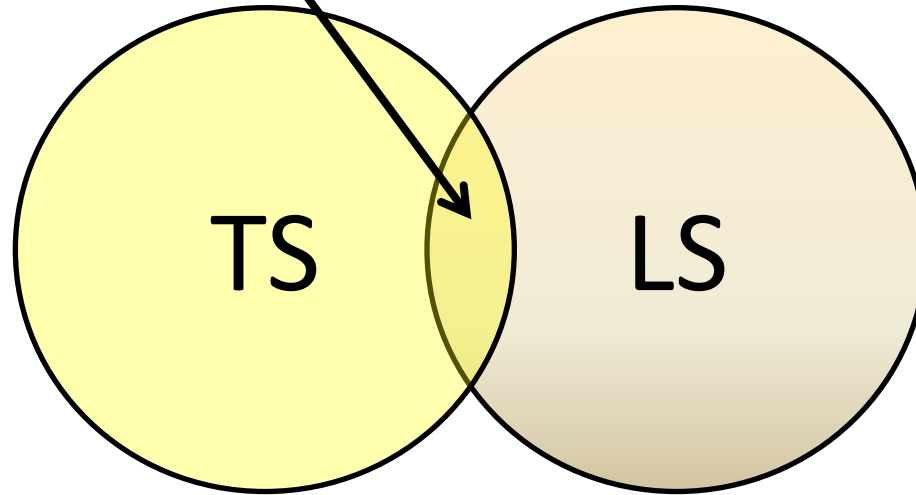
Students' (N=21) Learning Style Map



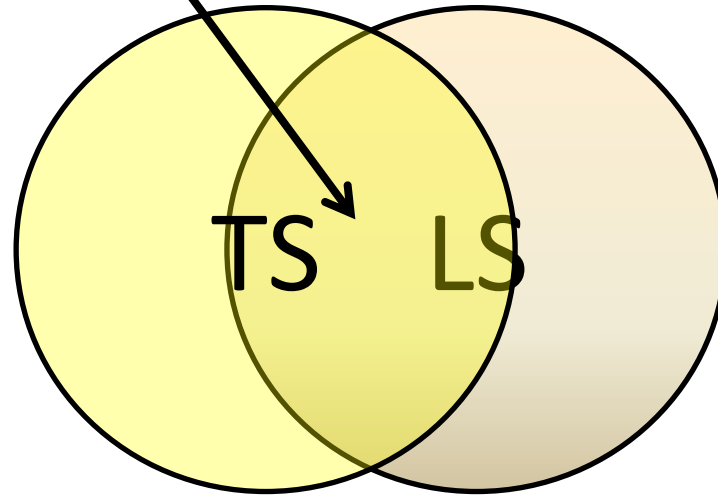
Results and Conclusion

- The learning styles map shows that students (N=21) have approximately equivalent preferences lies between fairly well balanced and moderate in the first two groups (ACT/REF and SEN/INT).
- In the third group (VIS/VER), students have strongly preference towards visible LS more than verbal LS.
- in the fourth group (SEQ/GLO), students show strongly preference towards global LS more than sequential LS.
- The previous data helps the teacher to **design the instructional situations as the student prefer**, **change the traditional classrooms to flexible classrooms**, and **achieving the harmony between teaching styles (TS) and learning styles (LS)**, which are lead to control and long-range learning.

where the magic happens



Increasing the effective learning area



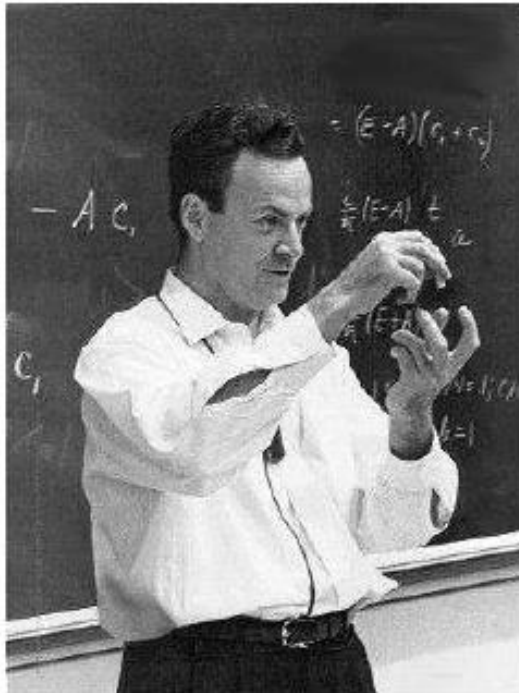
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Finally,

In 1959.

Richard Feynman gives his famed talk “There is Plenty of Room at the Bottom”



Richard Feynman © 1965

“What I want to talk about is the problem of manipulating and controlling things on a small scale.”

In this talk, Feynman said that we have progressed to the point where we can and should manipulate matter at what today we call the nano-scale.



THANK YOU

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