# THE SCIENCE BEHIND THE ART OF TEACHING A SCIENCE: IT'S ALL ABOUT PEDAGOGY

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### **MY PERSPECTIVE COMES FROM....**

- MIT Media Laboratory USA, 6 yrs
  IIS, University Memphis USA, 4 yrs
  IEEE Education Society
  - Guest Editor, Transactions on Education
  - Chair, Distinguished Lecture Program
  - Chair, Chapters Committee
- **o** IEEE, Educational Activities Board
- Computer Education Teacher, 25 yrs

### A META THOUGHT

• Talk to a different part of your brain!

# There were two people fishing...

# A META THOUGHT

#### • There were two men fishing...

- Symptom was identified as problem
- Cure the problem in addition to dealing w/symptom(s)

### **META ABSTRACT**

Emerging technologies will be what they will be (e.g., nano technology, laser optics, etc.).

The new technology-based delivery methods will facilitate critical changes in educational structure and curriculum. <u>And</u>, the changes in curriculum will, in-turn, **ATTEMPT TO** drive pedagogical changes.

# **META ABSTRACT (CON'T)**

- Professional organizations will become important stakeholders
- THINKING is the next emerging technology
- STORY TELLING (Socratic Method) may the next emerging skill for a professor
- Education will focus/shift to view content area as a Model-based Knowledge Domain

# ABSTRACT

- Technology-based delivery methods will force change in educational pedagogy, which will also force a change in educational structure,
- In order for technology changes to become <u>most</u> effective.
  - Pedagogy: rule-based to model-based
  - Systemic change in educational structure
  - Professional organizations co-equal players

### INTELLIGENCE, CURIOSITY...

I'm not that much smarter than anyone else, I just stay with a problem longer --Albert Einstein

# ELEMENTS OF LEARNING

- Engaging and participation involving local industries in shaping engineering education.
- Direction of a Research and Development program at the universities to serve the needs of industries and the community.
- Building a stronger interaction between universities and local professional societies for the betterment of the engineering profession

"Acquire knowledge, it enables its professor to distinguish right from wrong... it is our friend in the desert, our company in solitude and companion when friendless... it sustains us in misery, it is an ornament amongst friends... armor against enemies."

> Prophet Mohammed (peace be upon him)

### "ACQUIRE KNOWLEDGE..."

**Over the past 10 years and over the** previous century, we have seen mega change in, for example, transportation, medicine, and, communications! What change(s) has there been in Education, in teaching pedagogy in the past 10 years, in the previous century?

### Knowledge

#### Learners must understand the process Curiosity ⇒ Deep learning ⇒ Recursion

- Knowledge:
  - What is it?
  - Why is it good to have?
  - How do we acquire it?
  - What does it do? What is its function?
  - **o** How can it effectively function?

### BRICOLAGE

#### Learning Journey Analogy

Ordinary motion (Galileo)

Time Distance Velocity Acceleration Jerk

#### Learning Journey

Time Knowledge (beliefs) Learning Emotions Shock (astonishment)

# **ELEMENTS OF 'LEARNING'**

- Knowledge
- Wisdom
- Intelligence
- Information
- o Data
- Anecdote

### **EMOTIONS AND LEARNING**

• Learning is not a smooth journey

- Examples of relevant emotions (affective states of the learner)
  - Curiosity, Anxiety, Frustration, Bewilderment, Confusion, Dread, Disillusionment, Dispiritedness, Hopefulness, Satisfaction, Anguish, Confidence, Joy...

#### +0.5-0.5 -1 0 +1 anxiety worry discomfort comfort hopeful confident ennui boredom indifference interest curiosity fascination frustration confusion puzzlement insightful enlightened euphoric dispirited disillusioned dissatisfied wistful hopeful encouraged terror dread apprehension calm enchanted enthralled awe humiliation embarrassed chagrin content pleased prideful

**Emotion Axes** 





### **KNOWLEDGE DOMAINS**

#### • Rule-based (e.g., language)

• learn the rule, you have the knowledge

#### • Model-based (e.g., sciences)

• recursion, deep learning, understand the model and be able to apply it







# **IN CONCLUSION...**

- Professional organizations will become important stakeholders
  - Flat world considerations
  - Curricular considerations
- Focus/shift to view content area as a Model-based Knowledge Domain
- The new delivery methods will facilitate critical changes in educational structure and curriculum.

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