

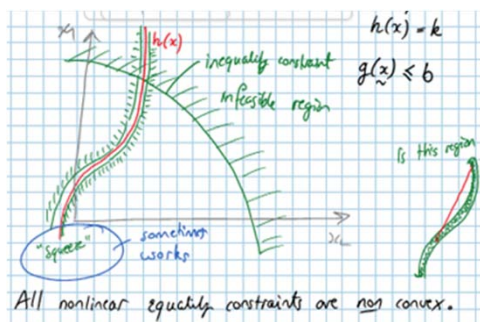
## Redeveloping A Signature Pedagogy For Engineering: Responding To New Spaces And New Technologies

**Peter Maclaren**

Centre for Learning and Teaching  
AUT

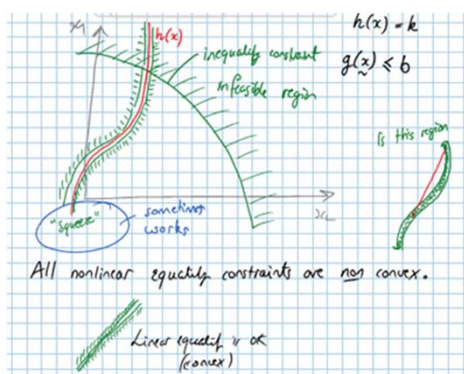
**David I. Wilson**

School of Engineering  
AUT



## Signature Pedagogies

“the characteristic forms of  
teaching and learning”  
associated with particular  
professions



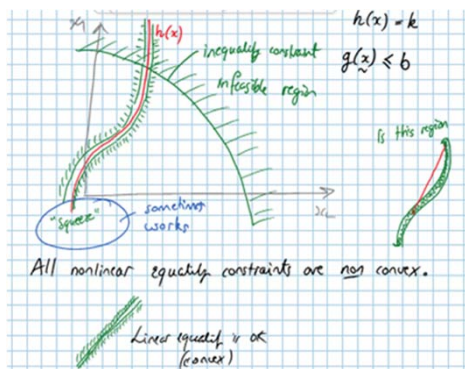
**Signature pedagogies in the professions**

Lee S. Shulman  
Daedalus Summer 2005

## Signature Pedagogies

“the characteristic forms of teaching and learning” associated with particular professions

..... implicitly define what counts as knowledge in a field and how things become known.



### Signature pedagogies in the professions

Lee S. Shulman

Daedalus Summer 2005

## Signature Pedagogies

“... even determine the architectural design of educational institutions..”



Laurentius de Voltolina mid -14<sup>th</sup> century

Image Source:

[http://commons.wikimedia.org/wiki/File:Laurentius\\_de\\_Voltolina\\_001.jpg](http://commons.wikimedia.org/wiki/File:Laurentius_de_Voltolina_001.jpg)

### Signature pedagogies in the professions

Lee S. Shulman

Daedalus Summer 2005

## Signature Pedagogies

“... even determine the architectural design of educational institutions..”



Lord Kelvin's lecture theatre, University of Glasgow  
<http://www.physics.gla.ac.uk/theDepartment/lectureTheatre.html>

### Signature pedagogies in the professions

*Lee S. Shulman*

Daedalus Summer 2005

## Signature Pedagogies

“... even determine the architectural design of educational institutions

... which in turn serves to perpetuate these approaches.”



Martin Wood Lecture Theatre, University of Oxford  
<http://www.physics.ox.ac.uk/datagrid/images/dscf1110.jpg>

### Signature pedagogies in the professions

*Lee S. Shulman*

Daedalus Summer 2005

## Signature Pedagogies

“... even determine the architectural design of educational institutions

... which in turn serves to perpetuate these approaches.”



WG Large Lecture Theatre AUT

### Signature pedagogies in the professions

*Lee S. Shulman*

Daedalus Summer 2005

## Chalk Talk

a characteristic genre in mathematics based disciplines

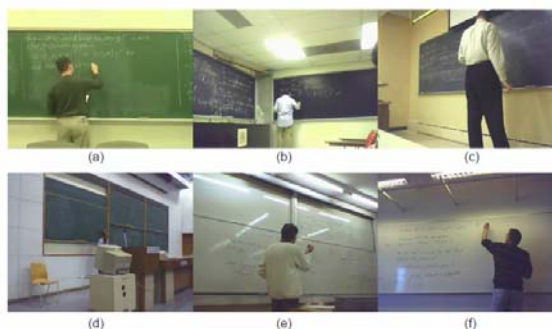


Figure 2 from:

### The cinematic art of teaching university mathematics: chalk talk as embodied practice

*Fox, J & Artemeva, N*

from: *Multimodal Communication* 1(1), pp. 83-103 December 2011

## Chalk Talk



‘In our view, the chalk talk genre is not only central to the teaching of mathematics but can also be **pedagogically interactive, meaningful, and engaging** as a way into disciplinary doing and being.’ (Cobb, 2000, p. 30).’

*in The cinematic art of teaching university mathematics: chalk talk as embodied practice*  
 Fox, J & Artemeva, N  
 from: Multimodal Communication 1(1), pp. 83-103 December 2011

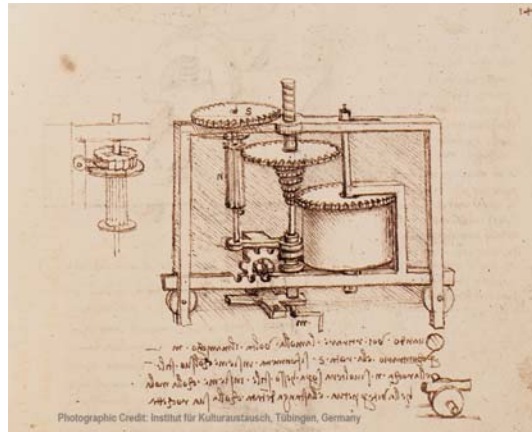
## Chalk Talk - Changes in Spaces - Changes in Technology





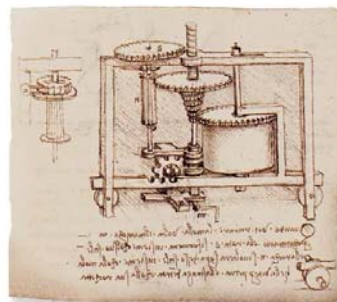
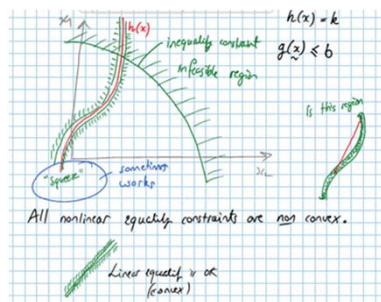
## Sketching Thinking

Dynamic  
diagrammatic  
Reasoning  
processes

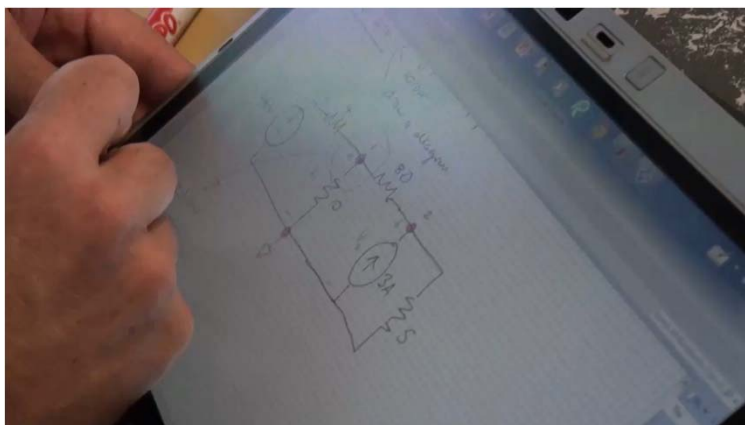


Variable Transmission  
Leonardo Da Vinci 1490

## The Digital Interface

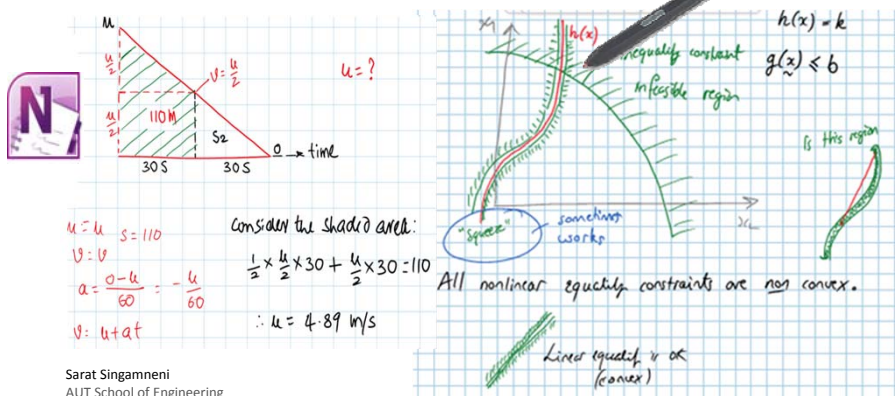


## Using the Tablet PC in Class



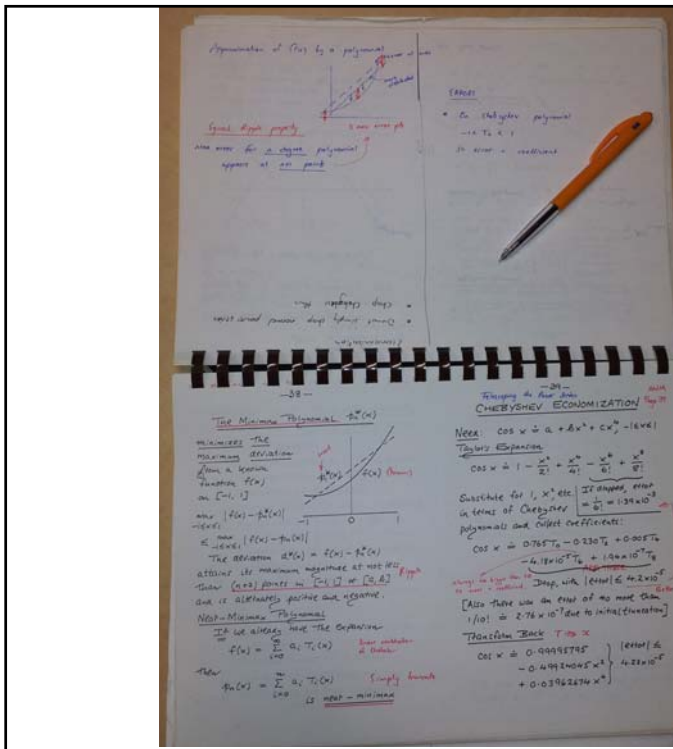
Circuits and Waves: Tutorial : David I Wilson

## Tablet PC Use - In Class



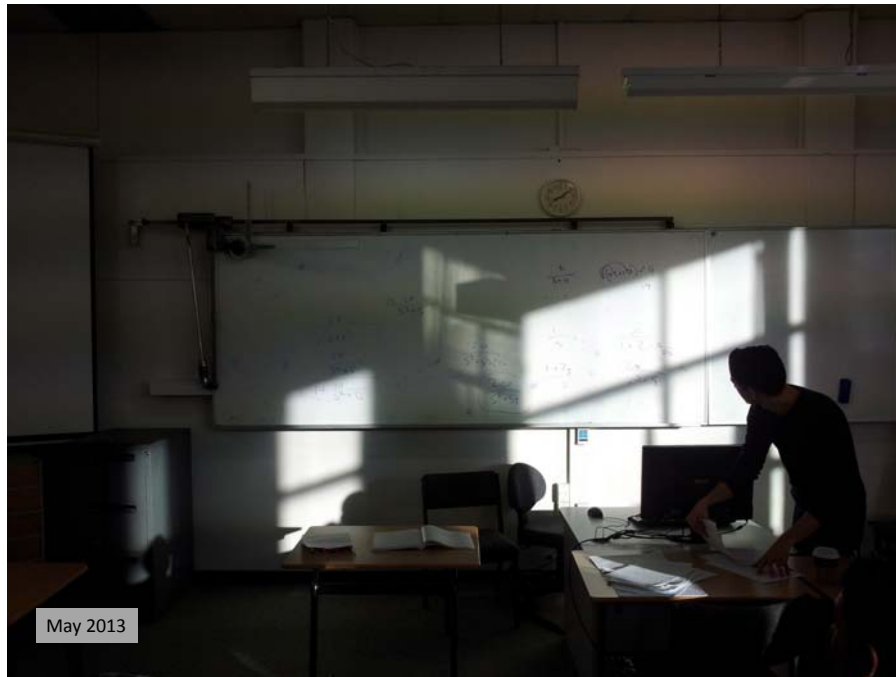
Sarat Singamneni  
AUT School of Engineering

## The importance of sketching



Notes in Numerical Analysis:  
James O. Wilkes, ~1985





May 2013

```

Assembler part is compiled and stored to disk as an object file.
Note the compile directives I use. (You could use something different)

; File: STDASM.ASM (Stack demo)
COMMENT *
From Shell.ASM for external Procedures & Functions for Turbo Pascal
For TASM or MASM and Turbo Pascal ver 4.0, 5.0, & 5.5
Ref: Tom Swan "Mastering Turbo Pascal ver 5.5" p506-508
Compiling instructions:
TASM /x1 /i filename.asm ; generate debug & listing
*

DATA    SEGMENT WORD PUBLIC
UsePort  dw  ? ; Com port number for example
DATA    ENDS ; end of data segment

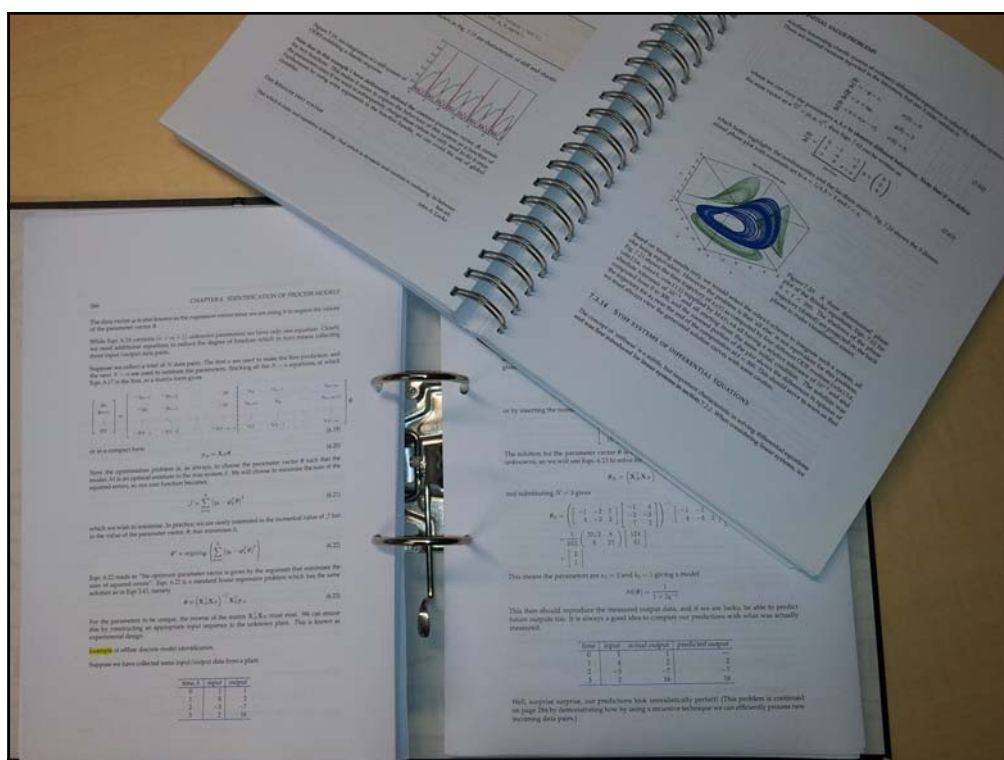
CODE    SEGMENT WORD PUBLIC
ASSUME CS:CODE, DS:DATA
PUBLIC tfunc

;-----
; Function tfunc(Byte1,Byte2,Byte3) : word
tfunc PROC  NEAR ; Use FAR if compiled with [SF-] or in Unit
    push bp ; save base pointer
    mov bp,sp ; address parameters with bp
    ;----- user code starts here
    xor AX, AX ; clear AX and BX registers
    mov BX, BX
    ; load passed parameters LIFO
    mov BL, Byte Ptr [bp+04] ; 2nd parameter passed into function
    add BX, 10H
    mov AL, Byte Ptr [bp+05] ; 1st parameter passed
    add AX, BX ; return word by default
    ;----- user code ends here
    mov sp, bp ; restore stack pointer
    pop bp ; restore bp
    ret ; return, release additional bytes ?
tfunc ENDP

CODE    ENDS ; end of code segment
END ; end of text

```

David Wilson  
35/378086 Assembly Language Programming  
12 Assembler part 4UNIVERSITY OF  
KARLSBAD



$$p_4(x) = x^4 + 0x^3 - 27x^2 + 14x + 120$$

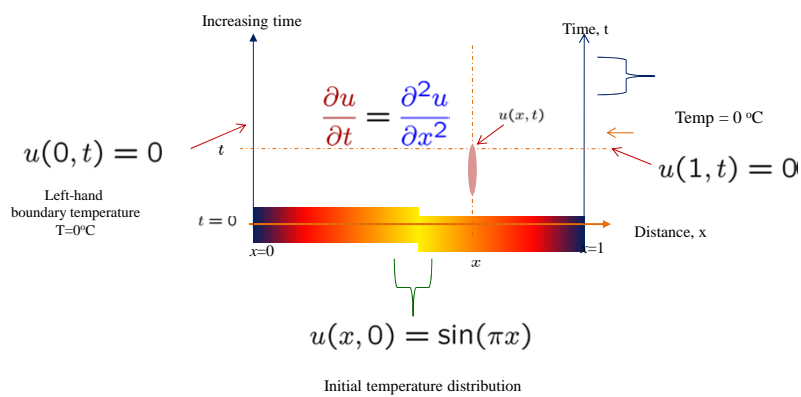
Suppose we use Newton-Raphson, and we have found a tentative root at  $x=-2$ .

- To find the others, (and avoiding finding the same root again), we form a new polynomial

$$14x + 120$$

- Now we found a tentative root at  $x=-2$ .
- Repeat the
- Do the div
- We expect polynomial
- Will have increasing round-off problems if the polynomial is ill-conditioned
- Could "flip" the polynomial to avoid some problems

### Metal rod cooling down (cont'd)



## General 1D parabolic PDE

- Our general 1-space D parabolic PDE is

$$c\left(x, t, u, \frac{\partial u}{\partial x}\right) \frac{\partial u}{\partial t} = x^{-m} \frac{\partial}{\partial x} \left( x^m f\left(x, t, u, \frac{\partial u}{\partial x}\right) \right) + s\left(x, t, u, \frac{\partial u}{\partial x}\right)$$

- With initial condition

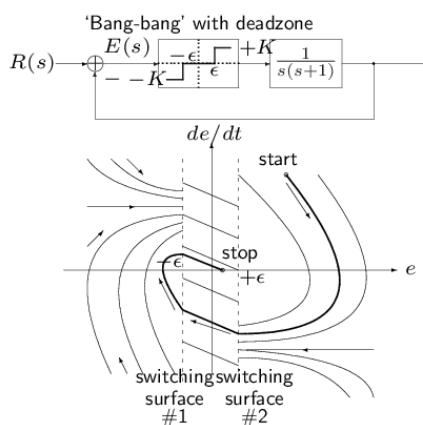
$$u(x, y_0) = u_0(x)$$

- And boundary conditions (at either end)

$$p(x, t, u) + q(x, t) f\left(x, t, u, \frac{\partial u}{\partial x}\right) = 0$$

**Adding a dead-zone** to the bang-bang controller prevents the continuous oscillation in control input.

*A bang-bang controller with a deadzone*

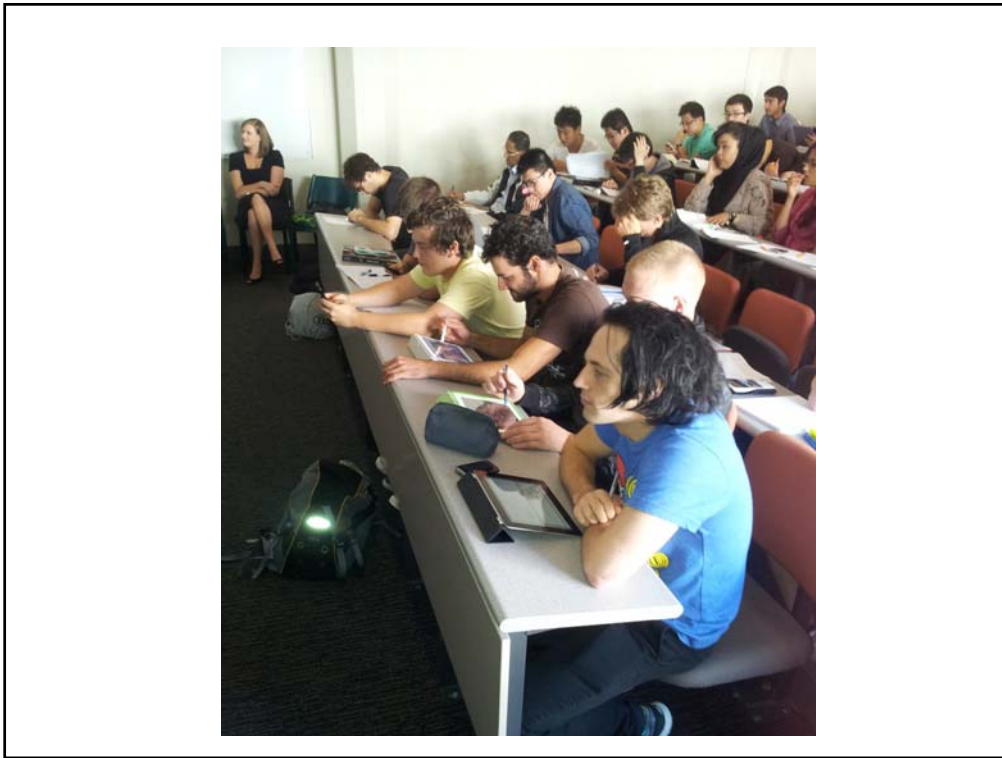


In this case once the  $\dot{e}(t)$  axis is reached, the system comes to rest (at 0), with a steady-state error of

The whiteboard contains the following equations:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -R/L_1 & 0 & -1/L_1 \\ 0 & 0 & 1/L_2 \\ 1/C & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 1/L_1 & 0 \\ 0 & 1/L_2 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$

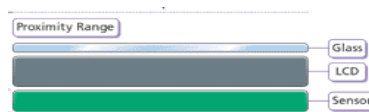
$$y = \begin{bmatrix} -R & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$$



## The Digital Chalk - Wacom Digitizer and Stylus

Uses Electro-Magnetic Resonance

- Precise
- Pressure sensitive
- Separate Digitizer from touch



<http://www.wacom-components.com/english/technology/emr.html>

## Handwriting on the iPad

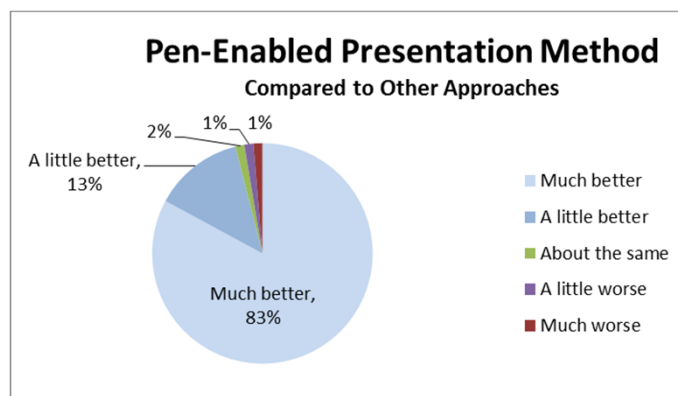
Uses Capacitive Digitiser

- Relatively imprecise
- Not Pressure sensitive
- 'Palm rejection' issues



## Pilot Survey of Students

96% rated the Tablet PC presentation method as an improvement



## Functional Improvements

- *easier to read – from anywhere in room*

## Student Engagement and Learning

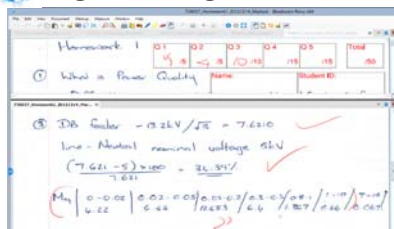
- *feel more involved*
- *student and lecturer working together*
- *much more interactive and relatable*
- *it makes the class more interesting and lively.*



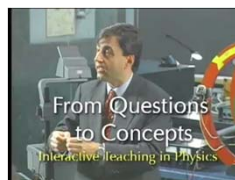
*This method is more effective in a way since we get to **see all the steps required/executed** in order to attain the final answer.*



## Digital Marking

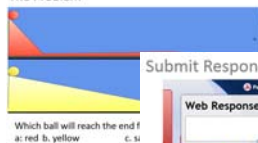


## Flipped Classroom



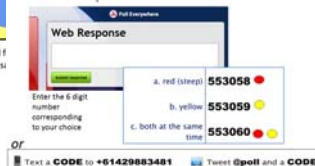
## Simulations and Polls

The Problem

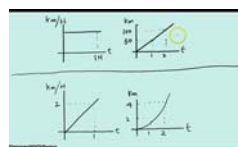


Which ball will reach the end f  
a. red b. yellow c. si

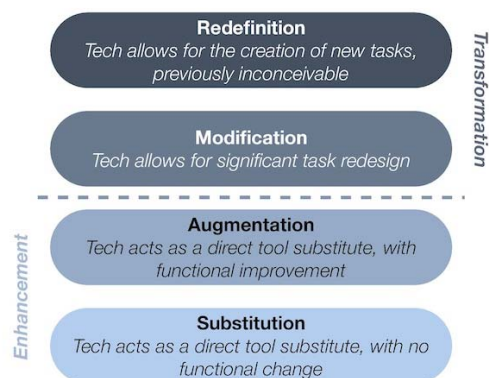
Submit Responses at PollEv.com



## Podcasts



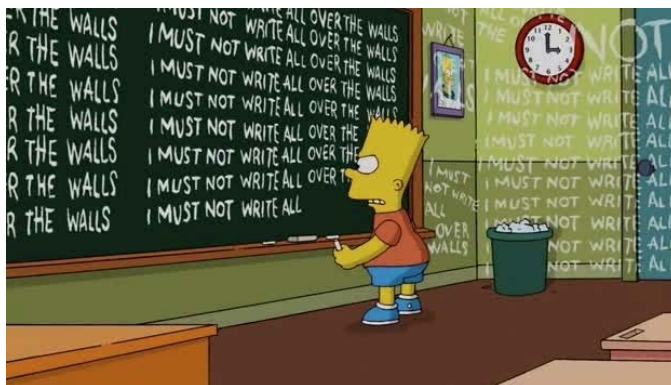
# SAMR – Transformative Approaches



Podcasts on iTunes U: <http://tinyurl.com/aswemayteach>

Dr Rueben Puentedura  
[www.hippasus.com](http://www.hippasus.com)

## Signature Pedagogies



The Simpsons:  
From: MoneyBART  
Season 22, Episode 3  
<http://bartsblackboard.com/>

## Questions?

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