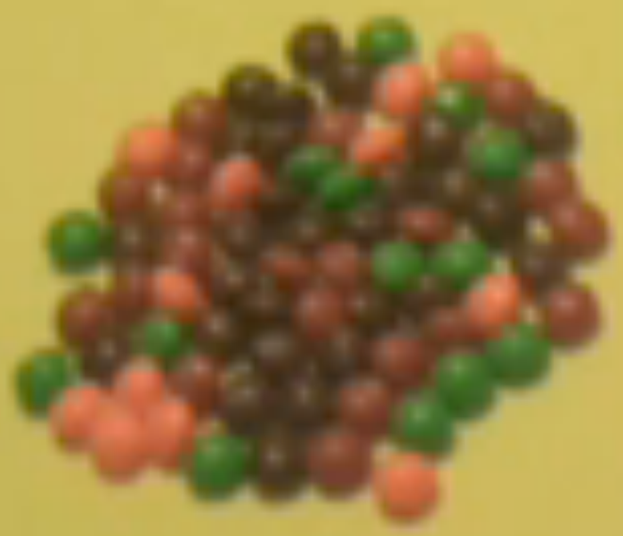
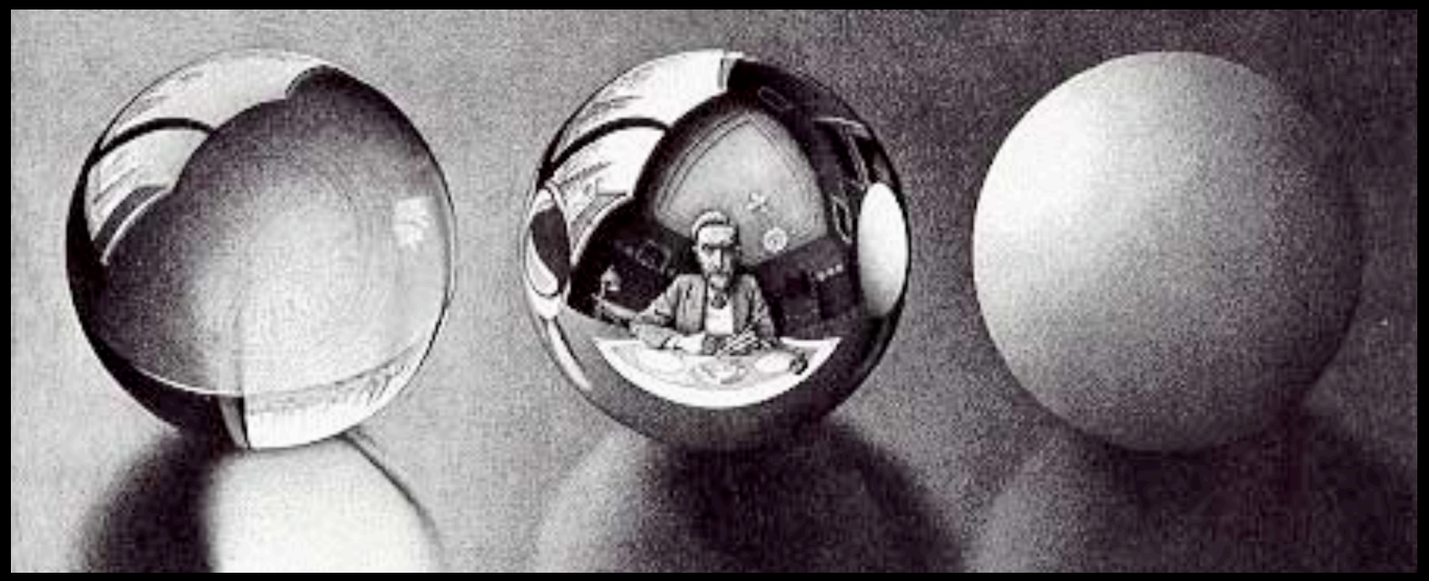
Magic Touch



Solutions to problems are easy to find,
the problem is a great contribution.
What's truly an art is to wring from your mind
a problem to fit a solution
— Piet Hein



Educational Technology & Teacher Education The TPACK framework

January 2009

College of Education

MICHIGAN STATE UNIVERSITY

My collaborator & friend

A true collaboration

The role of technology in teaching/learning (what do teachers need to know?)

Frozen in time?

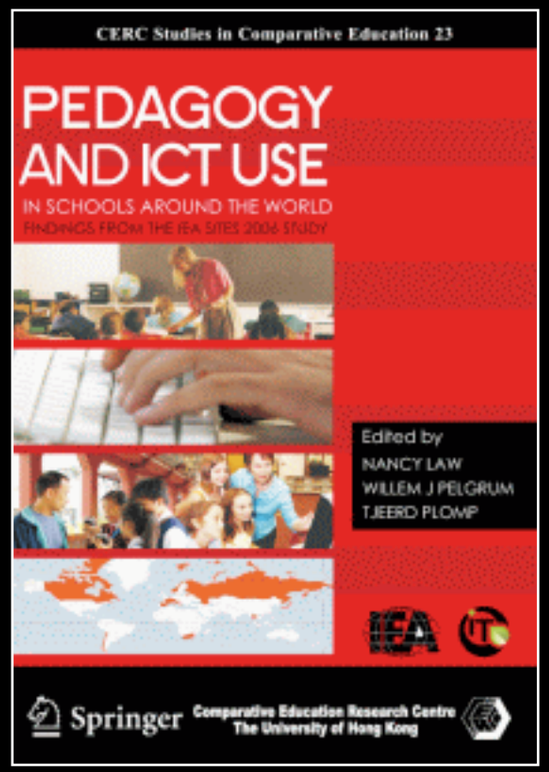
Generations	
10,000	speech
750	agriculture
500	writing
400	libraries
40	universities
24	printing
16	accurate clocks
5	telephone
4	radio
3	television
2	computers
1	internet/email
0	gps, mp3, youtube, web2.0 etc. etc.


SIMLIFE
THE GENETIC PLAYGROUND
myspace.com
a place for friends
Ask
RUNESCAPE
MATH BLASTER
EPISODE ONE
Adobe
Bb
Blackboard
SIEMENS
1 New Text Message(s) Received!
View
Later
Outlook Express
Java
LeapPad
Check Out the World of LeapPad!
RSS
HTML
You Tube
Broadcast Yourself
smart2go
odiogo
veoh
SayNow
twitter
plinkme
chatsum
audiozue
BackLinked
eons

So what are teachers to do?

How are they using technologies?

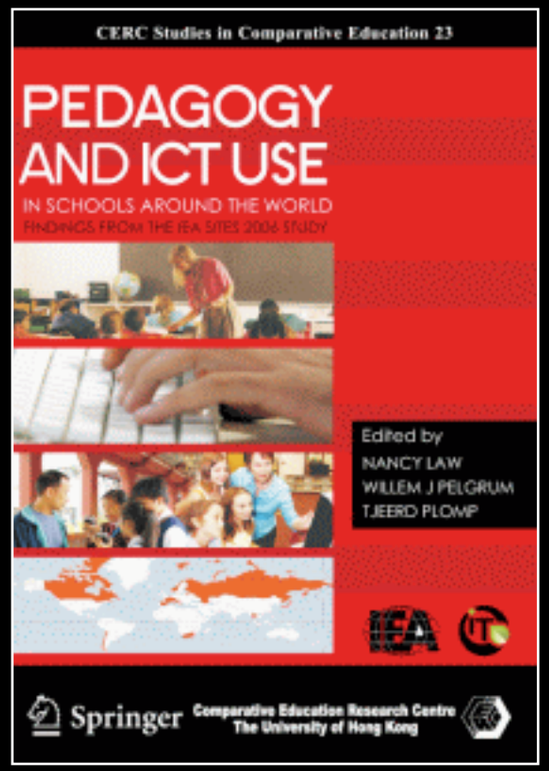
In the US



SITES 2006

IEA Second Information Technology in Education Study

Law, N., Pelgrum, W.J. & Plomp, T. (eds.) (2008). Pedagogy and ICT use in schools around the world: Findings from the IEA SITES 2006 study. Hong Kong: CERC-Springer.



9,000 schools and over
35,000 mathematics and
science teachers in 22
countries/education systems

NOT

that increased technology use led to student learning

INSTEAD

the effectiveness of technology use [ICT] depended on the teaching approaches used in **conjunction** with technology

AND

Pedagogical ICT competence was the best positive predictor of teachers' pedagogical adoption of technology"

THUS

it is NOT the technology alone, but rather how teachers integrate it with their teaching that matters.

IN OTHER's WORDS:

If you are not going to change pedagogy then technology use makes no significant difference

– Tom Reeves (yesterday, standing right here)

Technology Use

Technology Integration

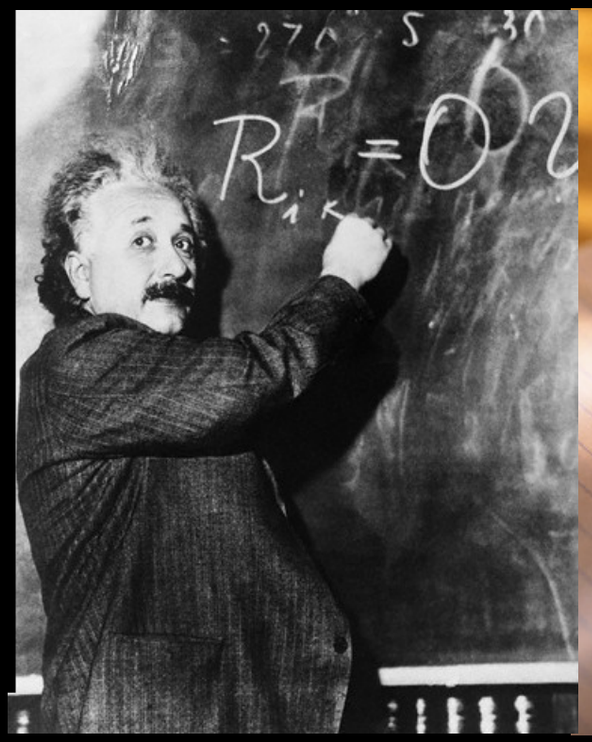
Technology Innovation

Technology

What is it?

Understanding

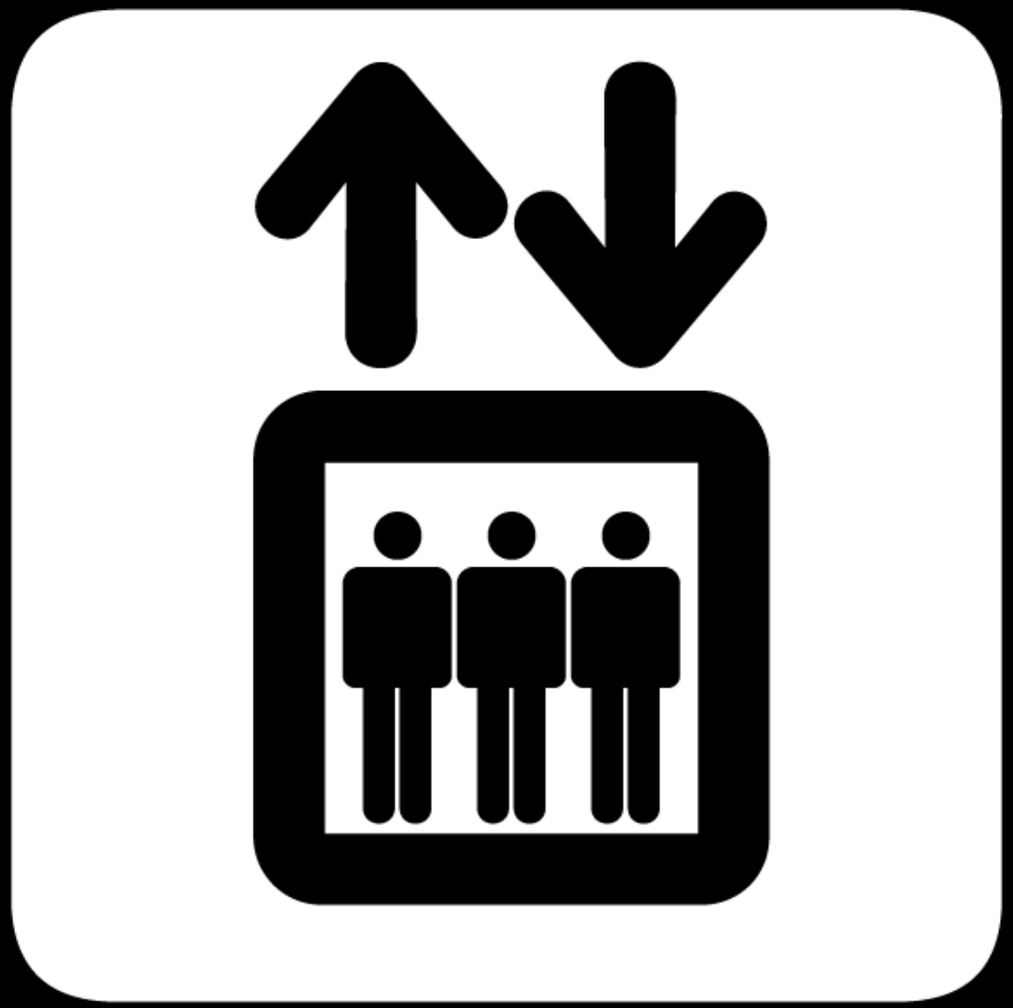

VAIO




MAGELLAN
Show Map
Enter Address
Points of Interest

Technology solves problems

But creates new ones



How?

Affordances

(and constraints)


Google
Docs
BETA


macromedia
DREAMWEAVER

But

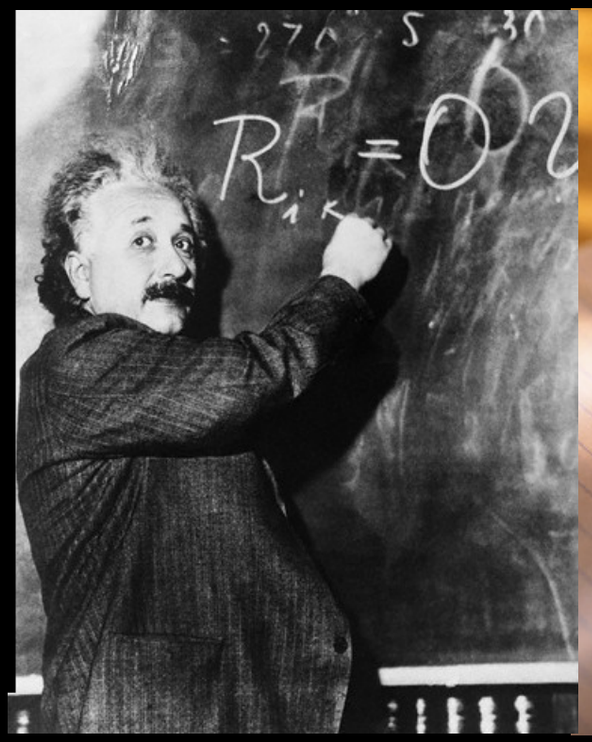
Users redefine
technologies


Tiger
Tiger

Why is this important?

Only repurposing makes a technology an educational technology..


VAIO

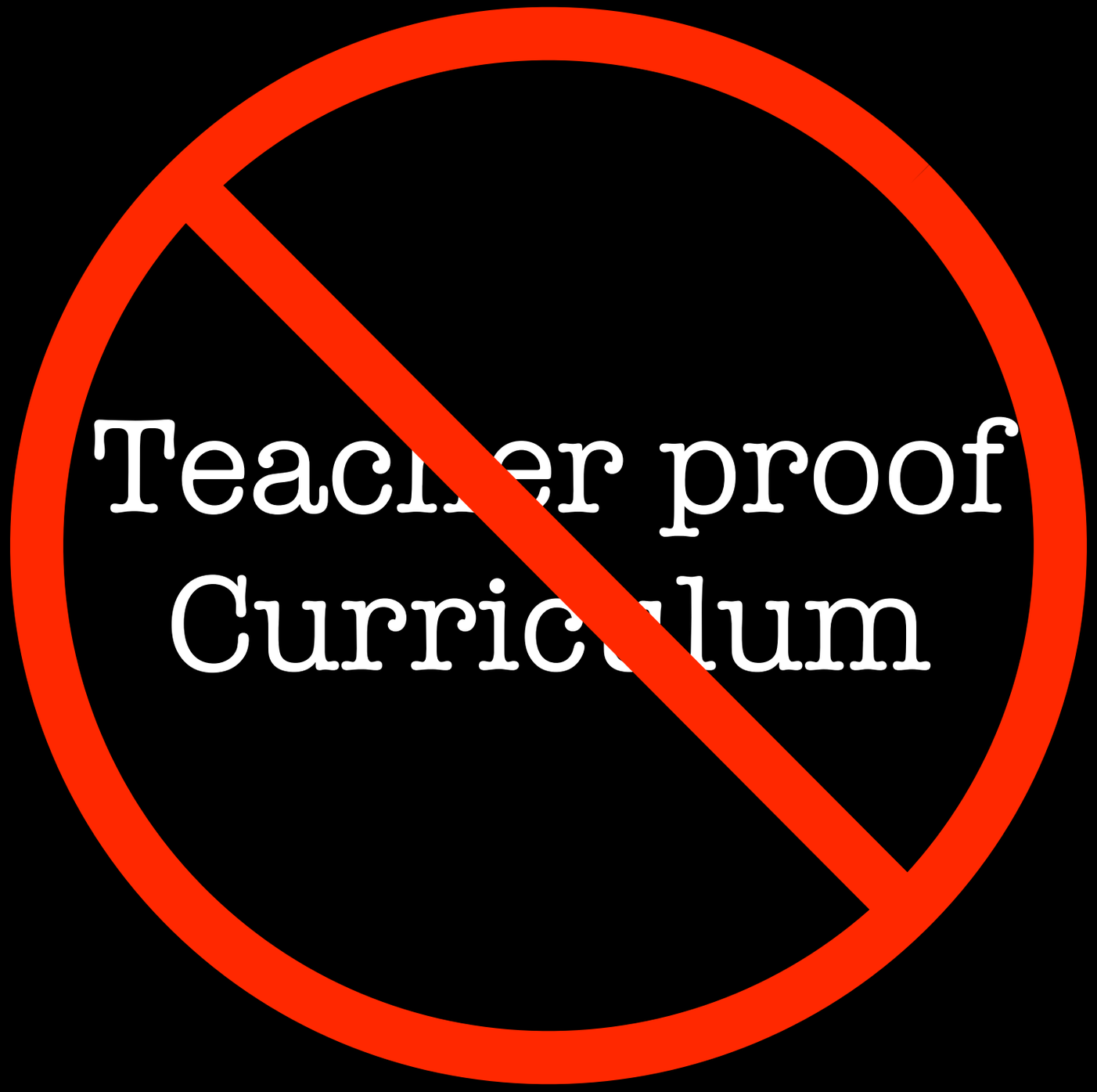



MAGELLAN
Show Map
Enter Address
Points of Interest


Access
Excel
PowerPoint
Word

This is a creative,
innovative act

The crucial mediating role played by the teacher...


Teacher proof
Curriculum

To sum up

Rapid rate of change

Understanding technology

- Affordances & constraints
- The importance of repurposing (from Tech to Ed Tech)

The crucial role of the teacher

Technology & Teaching

Pedagogy

knowledgeable,
accessible, wise,
funny, cerebral,
benevolent, fair,
firm, flexible,
playful, serious

… & more

Teaching is always about something

Content

The goals of education

The disciplines

Disciplines teach
us to see

Disciplines teach us to see

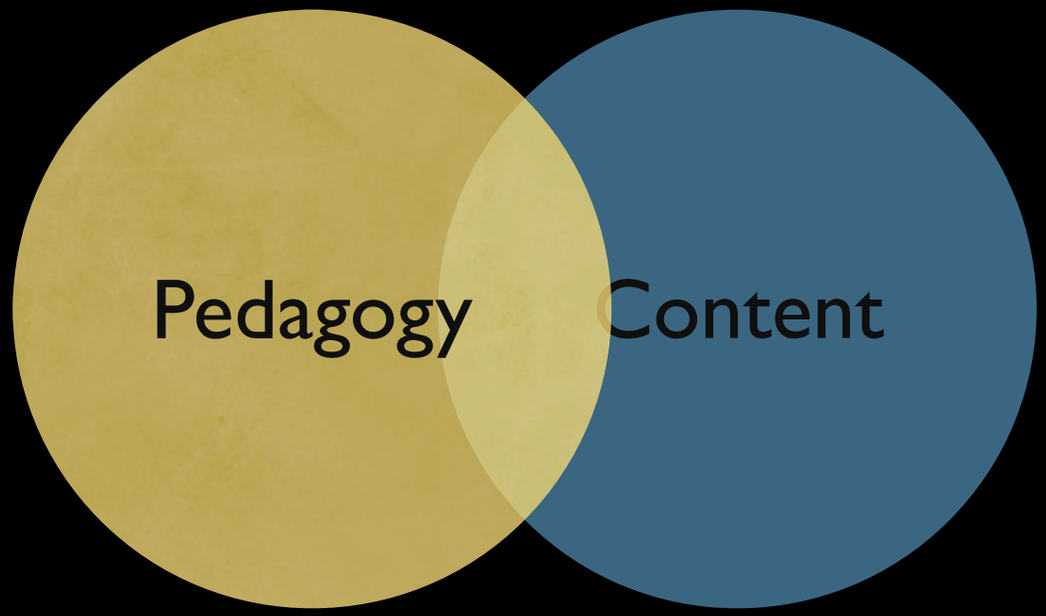
Knowledge | Methods | Purposes | Forms

Disciplines teach us to see

Knowledge	Methods	Purposes	Forms
facts, concepts relationships	knowledge creation & validation	reasons why disciplines exist	genres, symbol sytems

Knowing a discipline

Teaching a discipline


Pedagogy
Content

Mathematician

Not necessarily a good
teacher of math

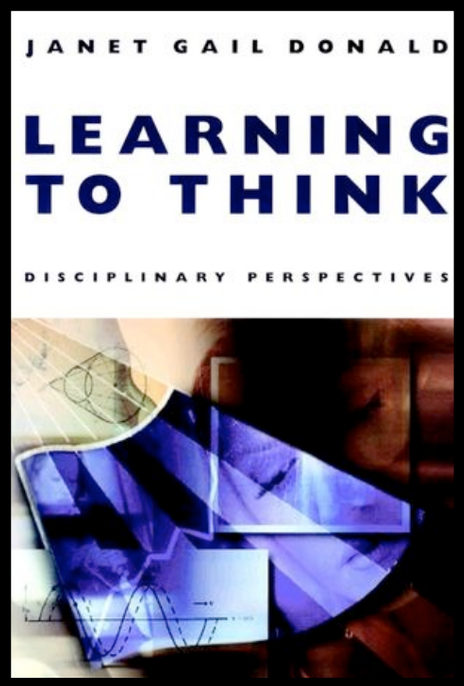
artist

physicist

economist

Quality teaching is

transformation of
content
for



in a disciplined
manner

To sum up

Teaching is messy & complex

The importance of
discipline(s)

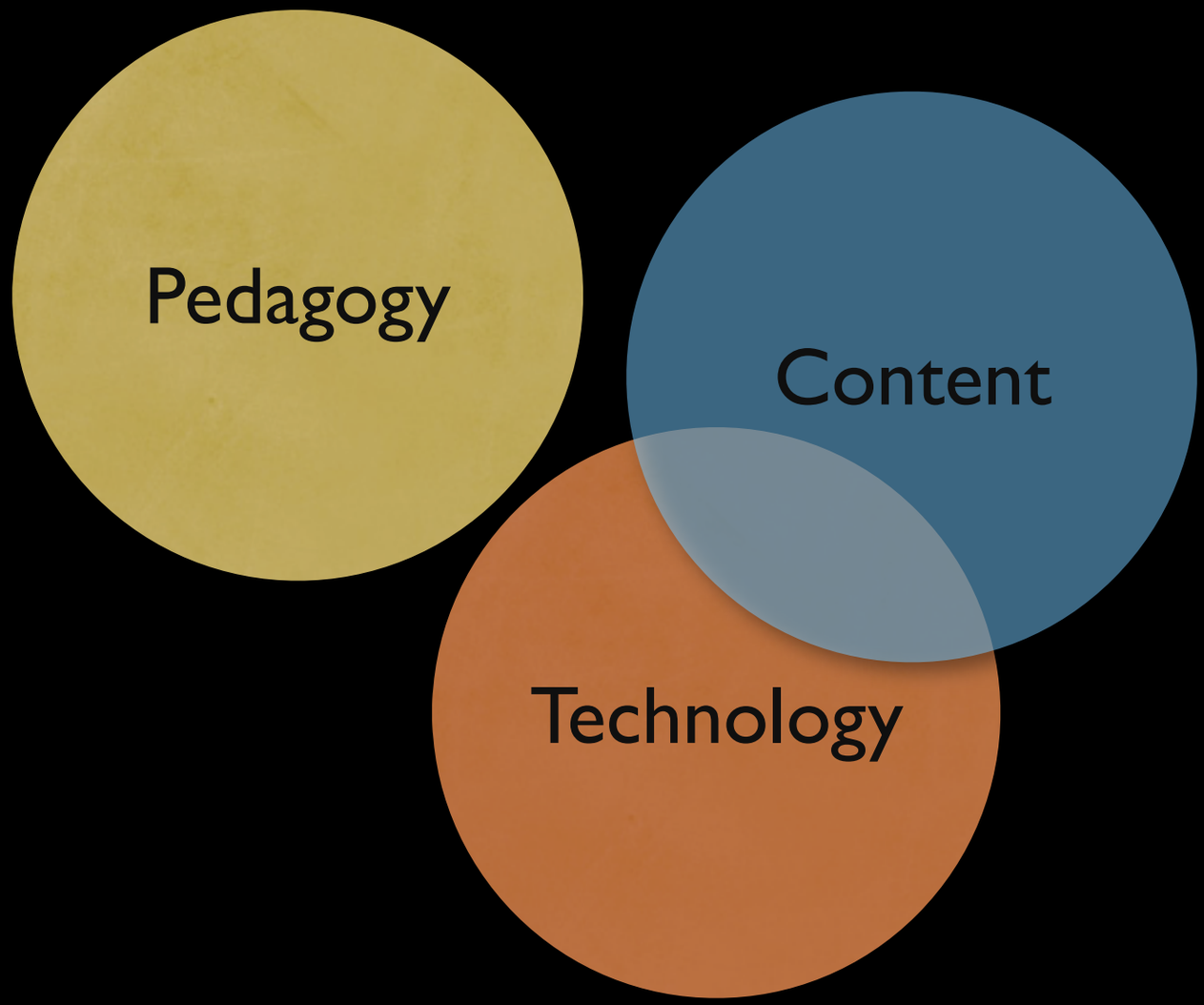
Teaching is about
transforming disciplinary
knowledge to meet the needs
of students

Adding technology

Pedagogy

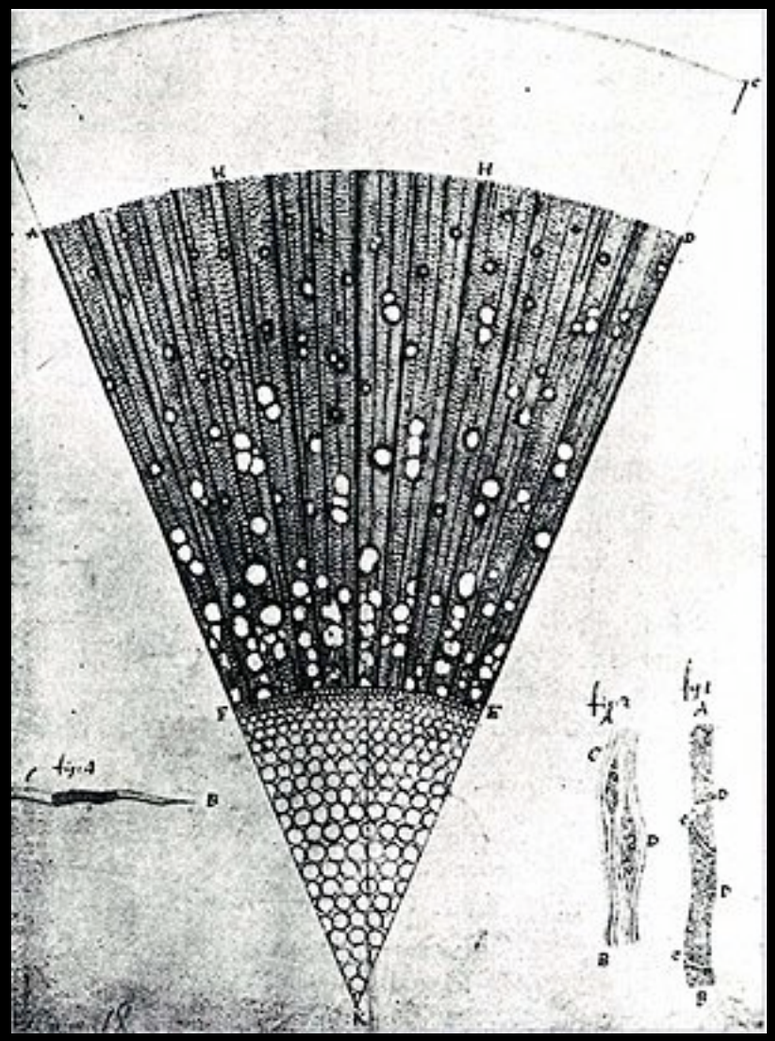
Content

Technology

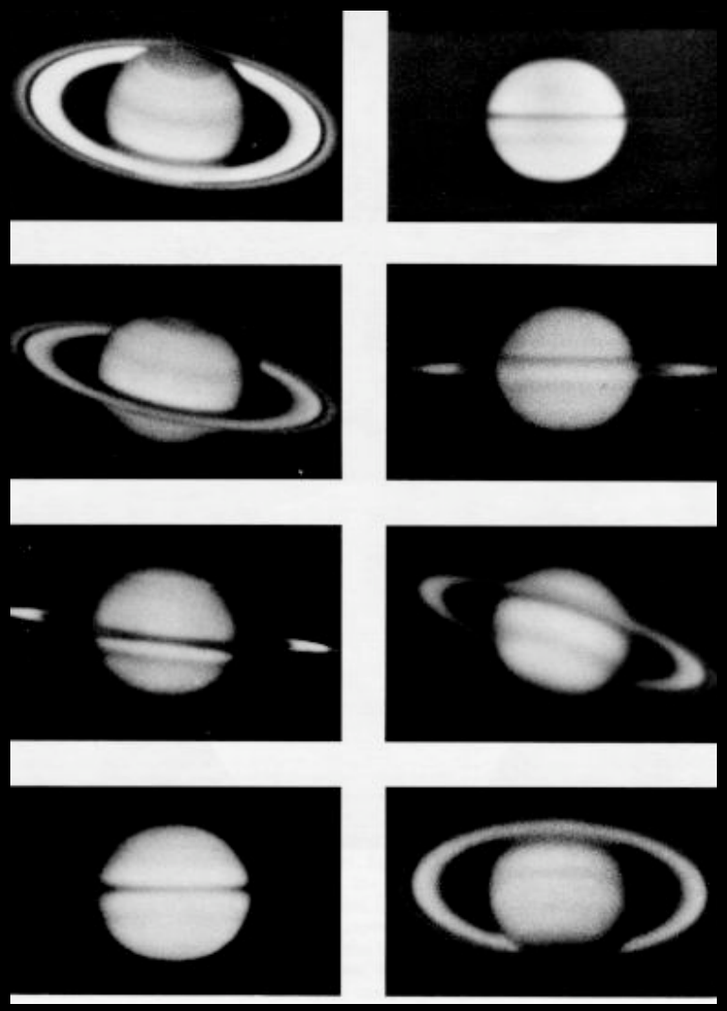

Pedagogy
Content
Technology

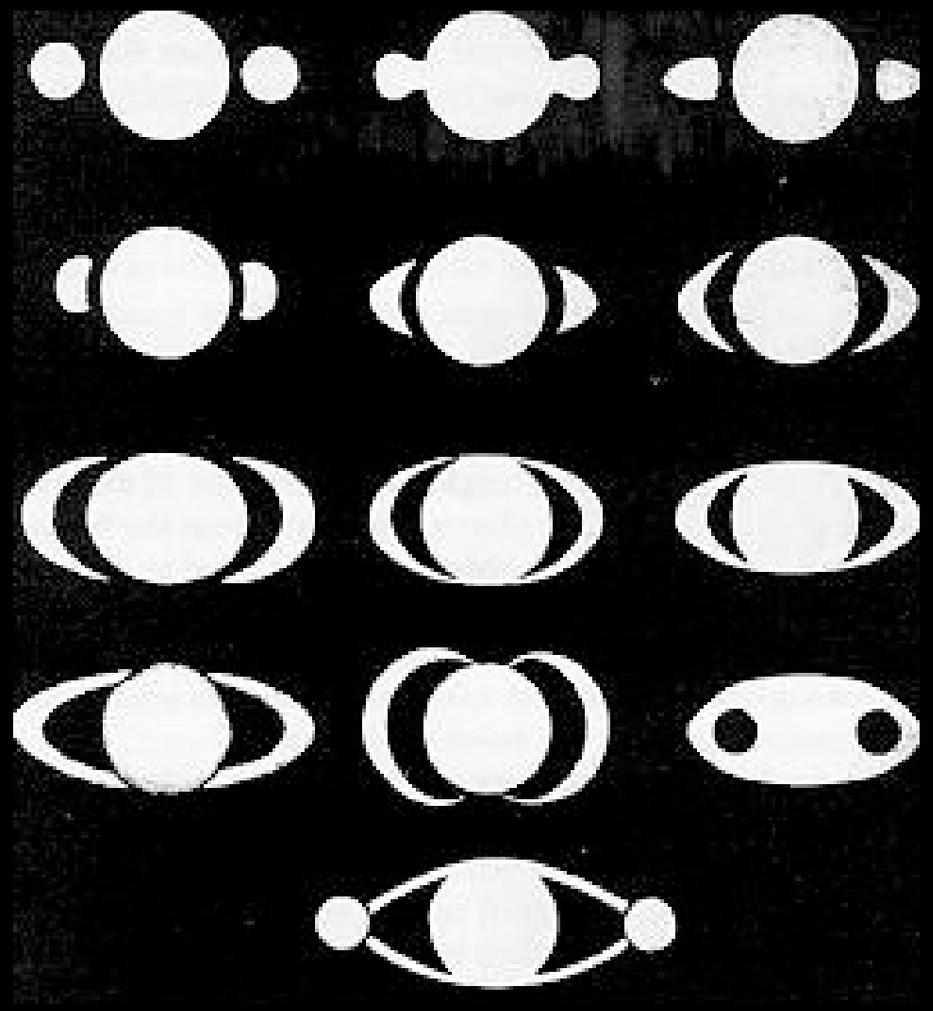
The transformation of content due to technology

mathematics
science
physics
engineering
history
political science
education
.
.
.



Antonie van Leeuwenhoek

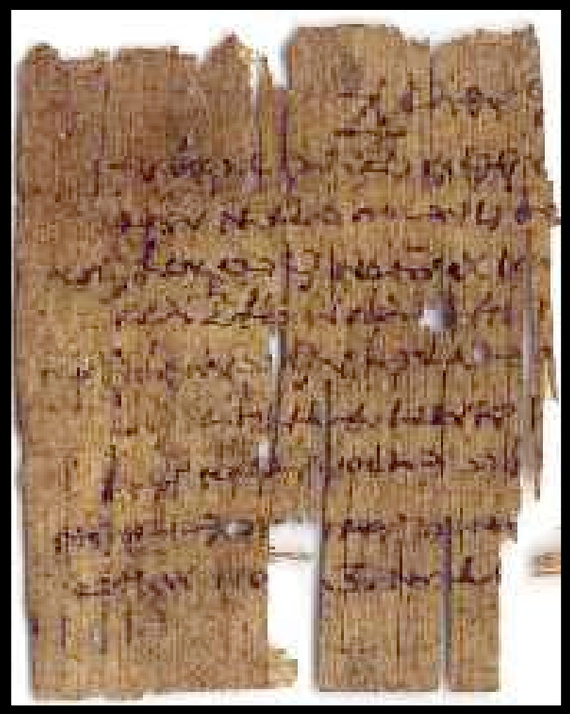


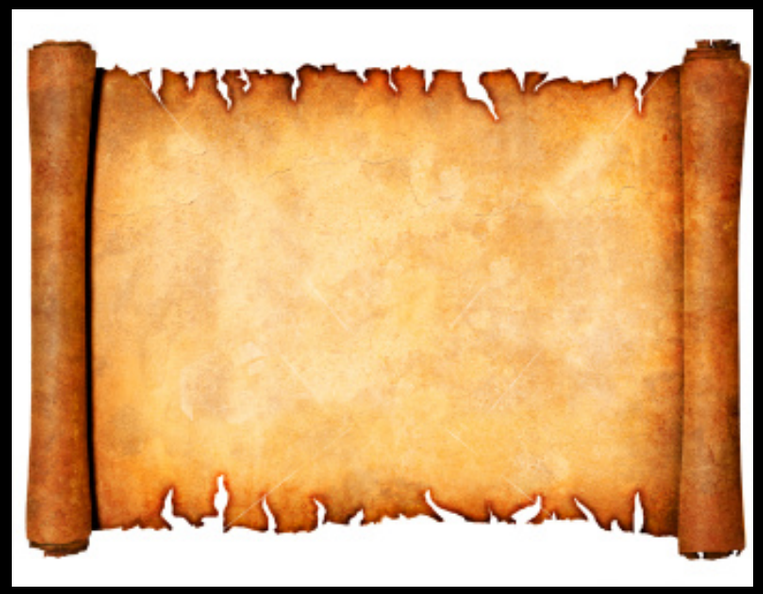


Christiaan Huygens

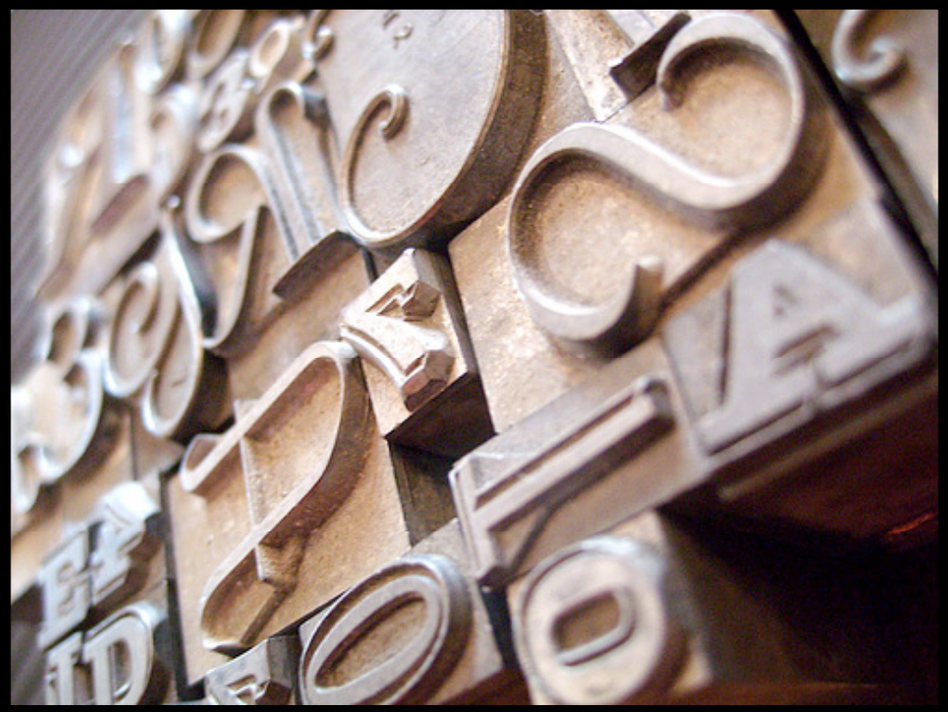
Literacy technologies

A book is a machine to think with






Ruins
Castles
OLD
BOOK
PICTURES
Cloisters bor




Lehr-Büchlein
Erste Lection.


The New York Times
FRONT PAGE


YouTube


shutterfly
PodDater
Feedster
Tailrank
TagWorld
nuvvo
dogear
yakaliko
grouper
Lulu
blish
flagr
FireAnt
rbloc.com
cafepress
Renkoo
oyogi
standpoint
YEDDA
Frappr!
jeteye
dabble
Writeboard
SHOUTWIRE
iKarma
CalendarHub
pando
zigtag
Findory
backfence
blogbeat
Ziggs
vSocial
Rallypoint
Zoozio
Opinity
measure
gumshoo
bluepulse
Tanda Lists
FeedSky
jellyBamINC
CONGOO
PODZINGER
RSS MAD
FeedTier
pharfare
flickr
Ning
Ookles
Strongspace
zoominfo
CASTPOST
FOTOLOG
FeedBurner
Bloglines
Yub.com
Spot Runner
NewsAlloy
Gcast
openomy
ajchat
Jambo
PANDORA
looklater
Noodly
30 BETA
windir
diigo
box

media

New ecology

New literacies

Periodic Table of the Elements

	IA												IIIA	IVA	VA	VIA	VIIA	0
1	1 H	IIA																2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg	IIIB	IVB	VB	VIB	VIIB	—— VII ——			IB	IB	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba	57 *La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	89 +Ac	104 Rf	105 Ha	106 Sg	107 Ns	108 Hs	109 Mt	110 110	111 111	112 112	113 113					

* Lanthanide Series	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
+ Actinide Series	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

s-Block

H	
Li	Be
Na	Mg
K	Ca
Rb	Sr
Cs	Ba
Fr	Ra

f-Block

La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No

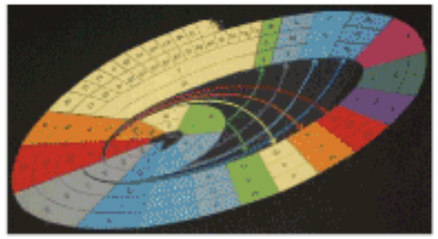
d-Block

Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd
Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg
Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub

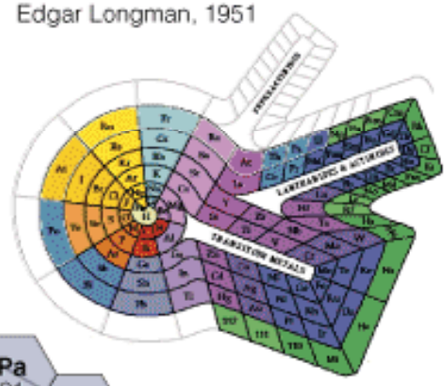
p-Block

					He
B	C	N	O	F	Ne
Al	Si	P	S	Cl	Ar
Ga	Ge	As	Se	Br	Kr
In	Sn	Sb	Te	I	Xe
Tl	Pb	Bi	Po	At	Rn
Uut	Uuq	Uup	Uuh		

EARLY SPIRAL DESIGNS



Edgar Longman, 1951



O. Theodor Benfey, 1960

Ununoctium discovery reported last week

HYDROGEN, HELIUM, ALKALI METALS AND ALKALINE EARTH METALS

TRANSITION METALS

LANTHANONS AND ACTINONS

K L M N O P Q

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Uuo 118 Rn 86 Xe 54 Kr 36 Ar 18 Ne 10 He 2

? 117 At 85 I 53 Br 35 Cl 17 F 9

Uuh 116 Po 84 Te 52 Se 34 S 16 O 8

Uup 115 Bi 83 Sb 51 As 33 P 15 N 7

Uuq 114 Pb 82 Sn 50 Ge 32 Si 14 C 6

Uut 113 Tl 81 In 49 Ga 31 Al 13 B 5

Uub 112 Hg 80 Cd 48 Zn 30 Cu 29 Ni 28 Co 27 Fe 26 Mn 25

Rg 111 Au 79 Ag 47 Pd 46 Rh 45 Ru 44 Tc 43 Cr 24

Ds 110 Pt 78 Ir 77 Os 76 Re 75 W 74 Mo 42 V 23

Mt 109 Hs 108 Bh 107 Sg 106 Db 105 Rf 104 Ta 73 Nb 41 Ti 22

Lr 103 No 102 Md 101 Fm 100 Es 99 Cf 98 Bk 97 Cm 96 Am 95 Pu 94 Np 93 U 92 Pa 91 Th 90 Ac 89 Ra 88 Fr 87

Lu 71 Yb 70 Tm 69 Er 68 Ho 67 Dy 66 Tb 65 Gd 64 Eu 63 Sm 62 Pm 61 Nd 60 Pr 59 Ce 58 La 57 Ba 56 Cs 55 Rb 37 Sr 38 Y 39 Zr 40 Hf 72 Na 11 Mg 12 Be 4 Li 3 K 19 Ca 20 Sc 21 H 1

File Edit View Go Bookmarks Options Directory Window

Netscape: [FLIPS]: Flexible Learning in the Periodic System

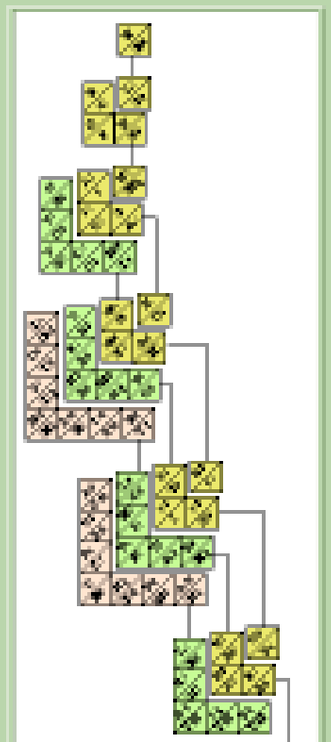
Back Forward Home Reload Images Open Print Find Stop

[FLIPS] Session 1

2. Tables and then 2.4 Treptow [next table | help | periodic home]

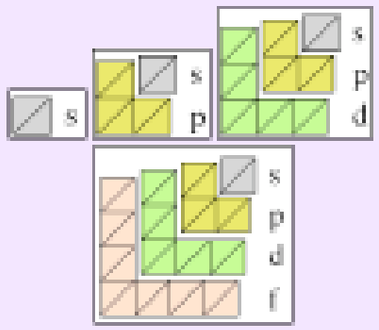
Treptow's Electronic Form

Description



✓ Select another table...
Standard
Spiral
Pyramid

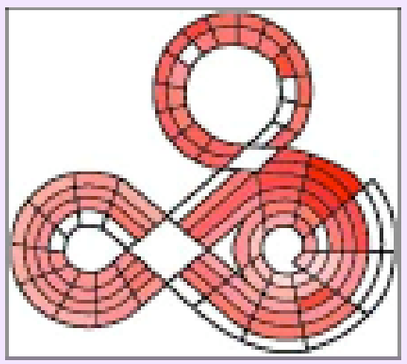
This table was first reported by Richard Treptow in 1994. It takes a very different approach to periodicity than the other tables. It does so by arranging sub-blocks of elements into progressively larger blocks as we increase the atomic number. There are 7 blocks, one for each value of n (the principal quantum number). Each block contains as many elements that can have the given principal quantum number i.e. $2n^2$.



The first block has one square - representing the 1s orbital. The top half gets the first element and the bottom half gets the next element. Notice how this clearly shows that the first element has an unpaired electron and the second one has two paired electrons of opposite spin.

Notice how we could determine the presence of paired and unpaired electrons in the electronic configuration of

The
radi
the smaller the atom. White cells designate elements whose atomic radii are yet unknown.



Atoms get bigger as we move outward among the representative elements.

Atomic radii show minor variation in the transition and inner-transition elements.

Also once again there is a sharp edge where the alkali metals -- lithium, sodium etc. start - though the halogens -- fluorine, chlorine etc. differ from them in just one atomic number.

File Edit View Go Bookmarks Options Directory Window

Netscape: [FLIPS]: Flexible Learning in the Pe

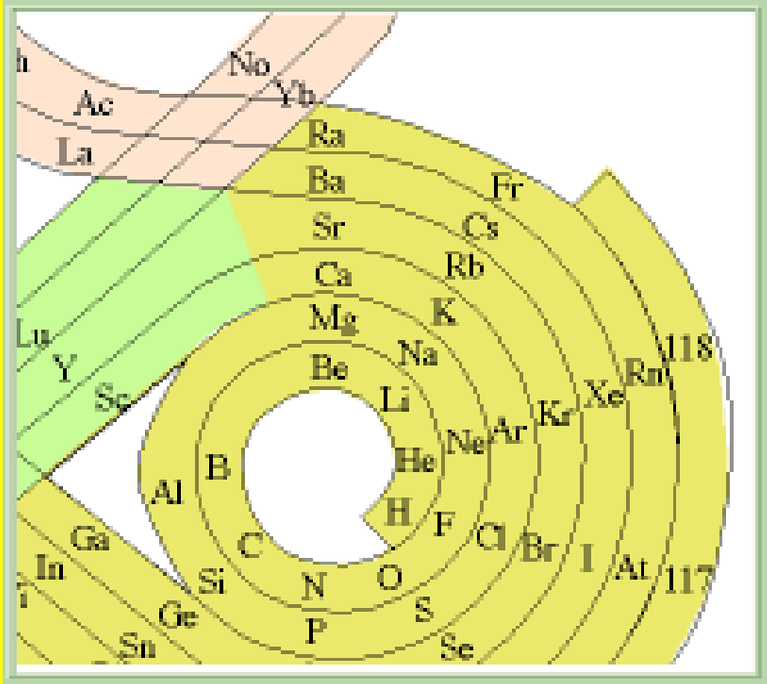
Back Forward Home Reload Images Open Print Find Stop

[FLIPS] Session 1

4. Tables and then 4.1 Standard

Janet's Spiral Form

Select theme...



To zoom in: click on the table with the "command" [apple] key pressed.
To zoom out: Click on the table with "command" AND "shift" keys pressed.
To move around: Drag across the table with the "control" key pressed.

To sum up

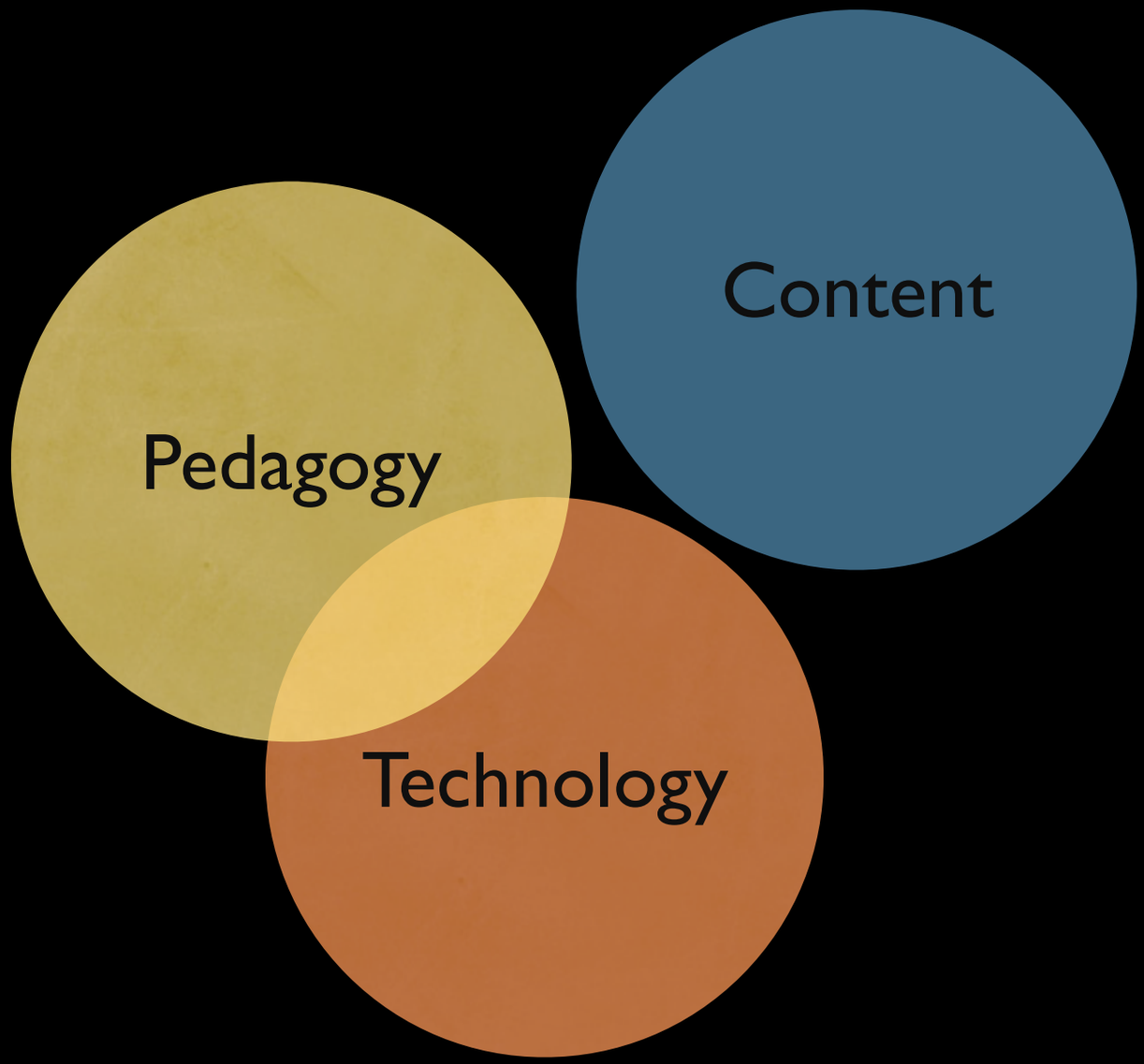
Technology & content
are intimately related!

Technology and the transformation of pedagogy

Pedagogy

Content

Technology


Content
Pedagogy
Technology


Google™

open courseware

Online learning

“me too!”

“I agree”

“I agree”

Hmmm…

“nice post”

“I agree”

“I agree”

Good job

“I agree”

“me too!”

Me too


Me too

Laptops in the classroom (the idea of micro-blogging)

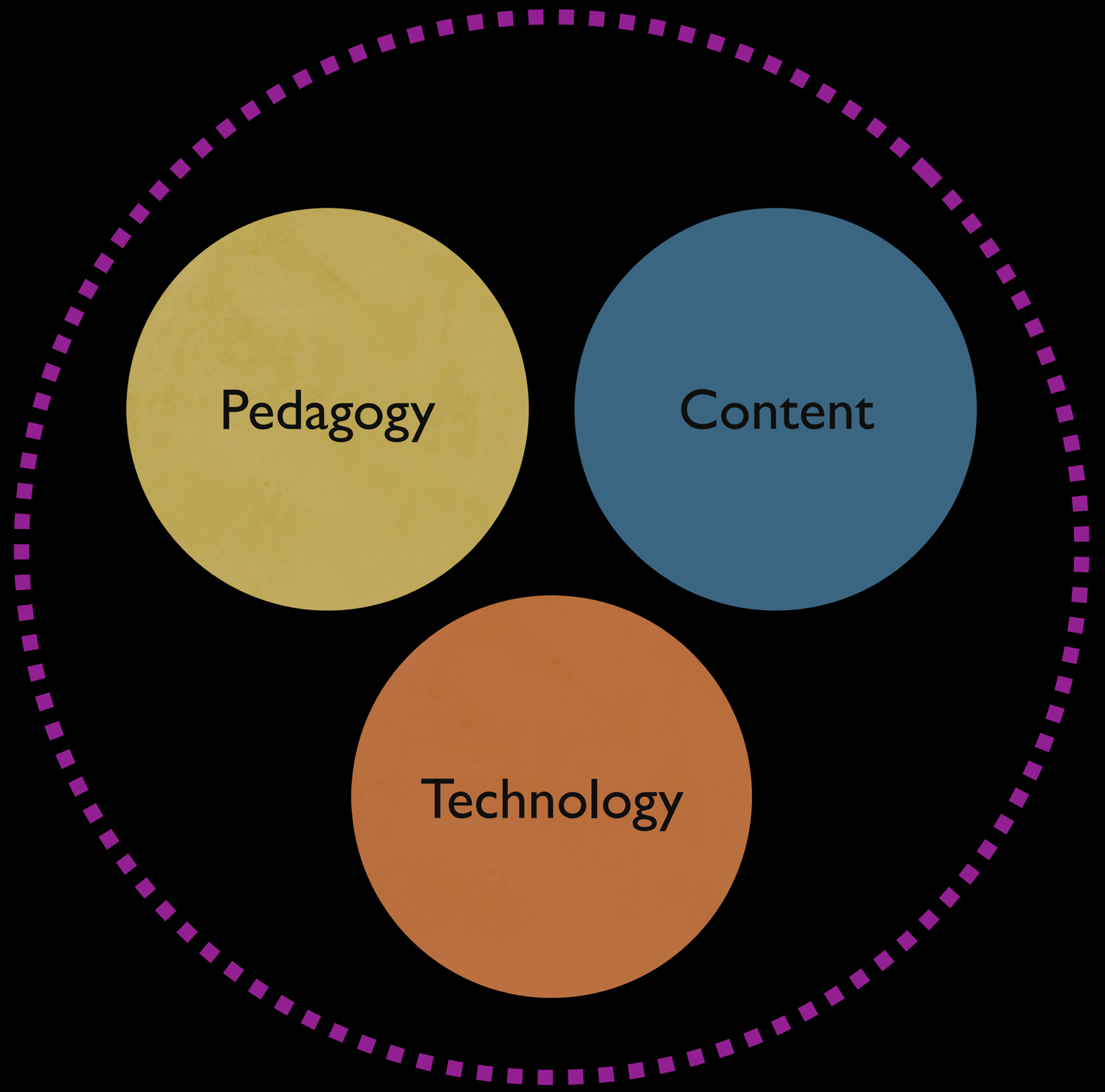
What have we covered so far?

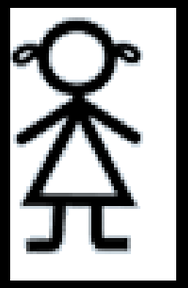
Pedagogy

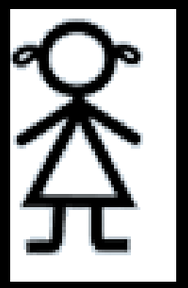
Content

Technology

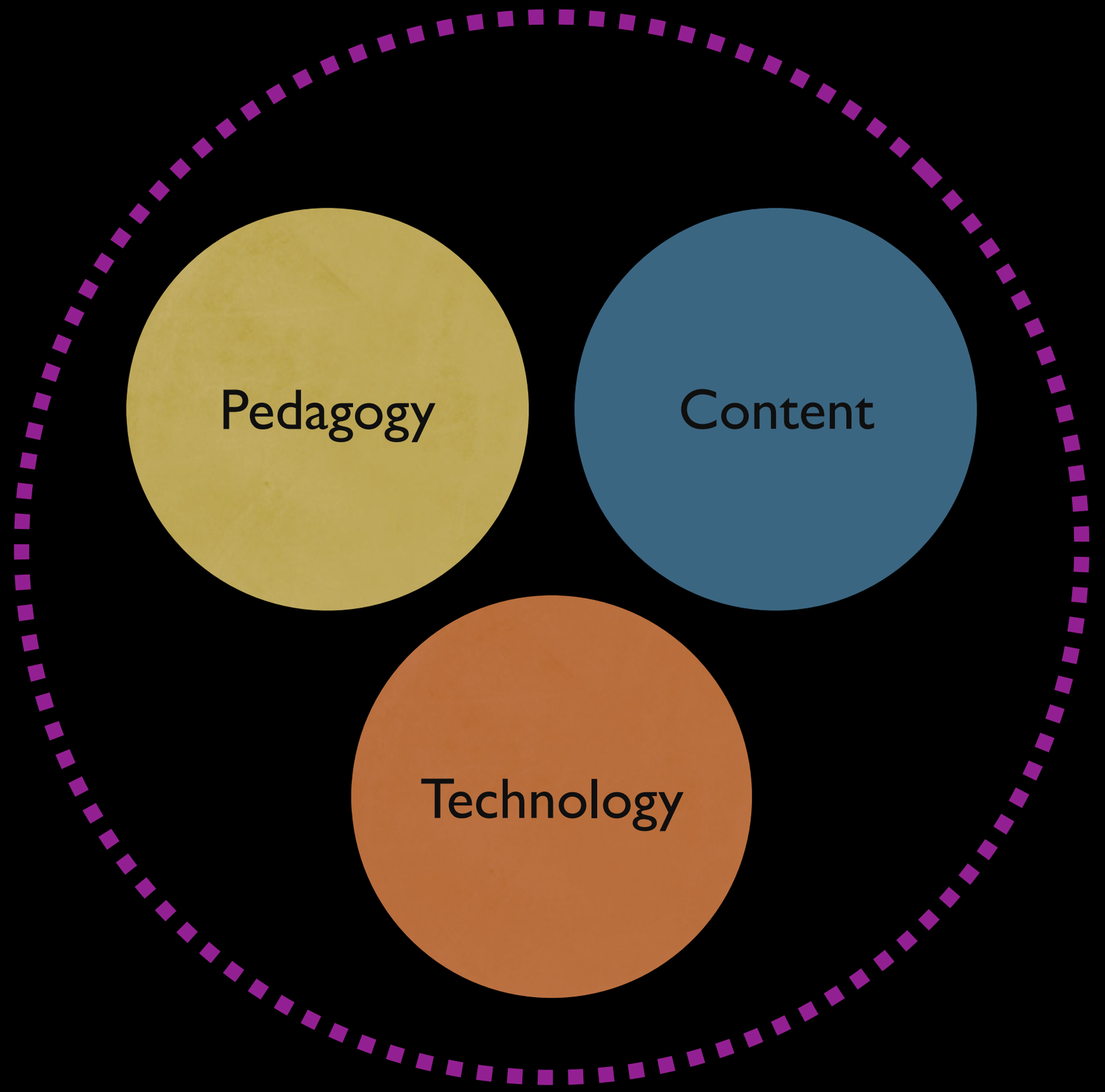
What's missing?


Pedagogy
Content
Technology
Context



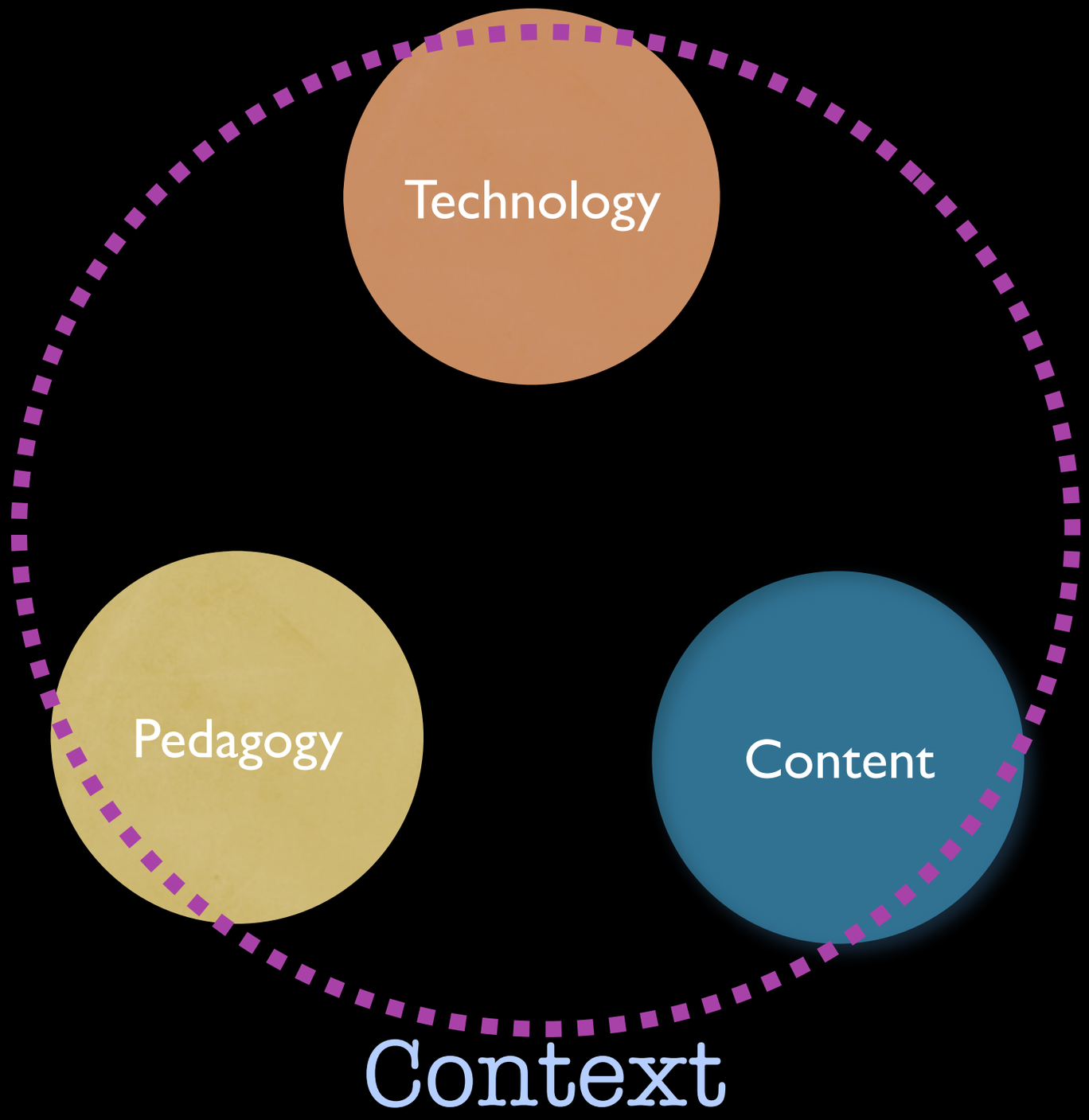


So?


Pedagogy
Content
Technology
Context

The most
important
overlap

TPACK Model



TPCK

Technological Pedagogical
Content Knowledge

And how are we supposed to pronounce this again?

ToothPiCK?

TPACK

Technological Pedagogical AND
Content Knowledge

TPCK

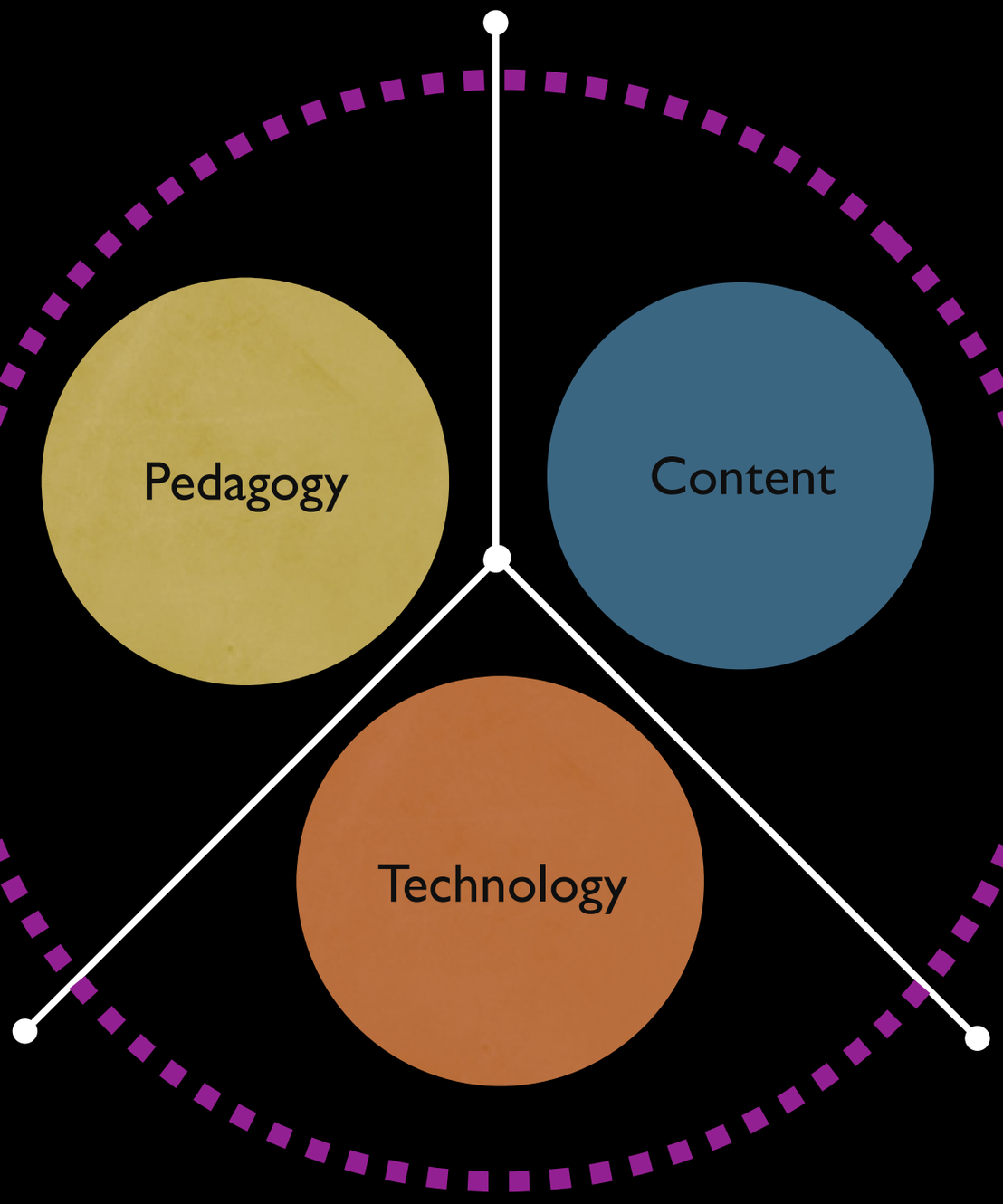
TPACK

Total PACKage

Total PACKage

The research
(a look back)

what doesn’t work



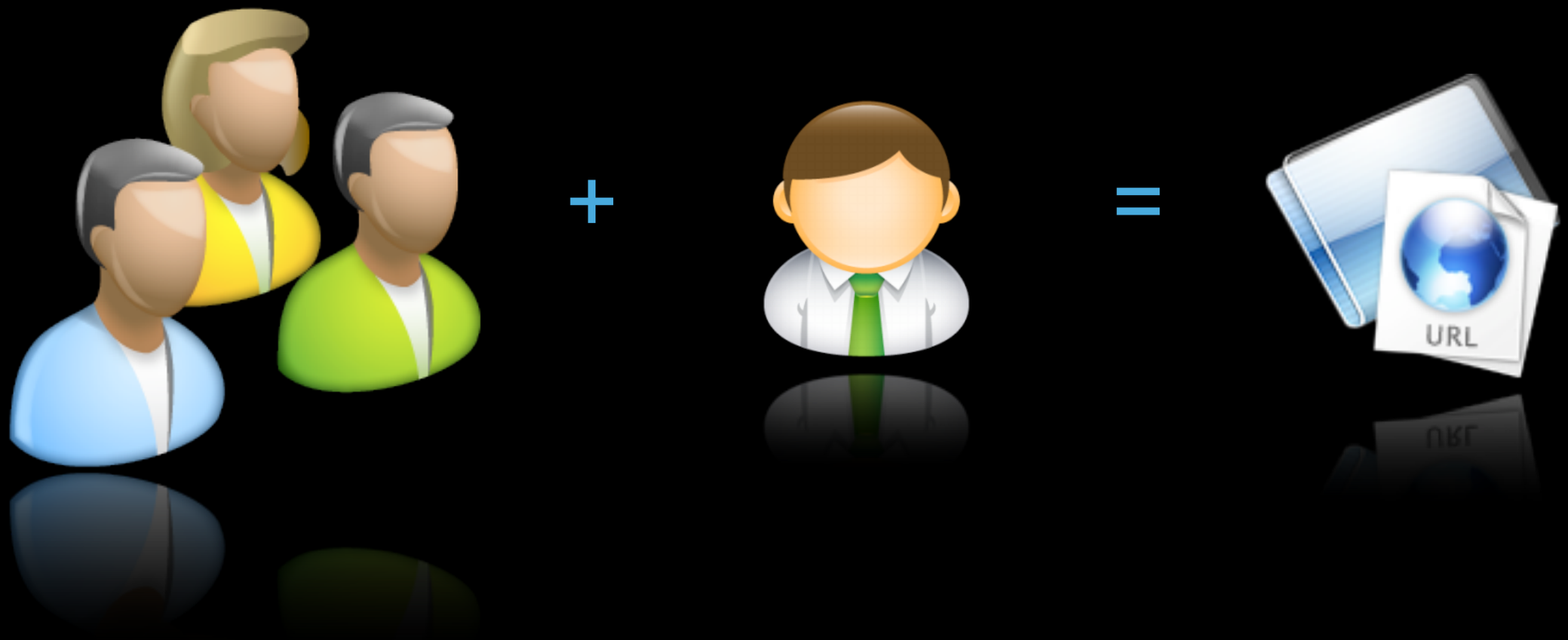
Context

… from thought

… to thing

Learning Technology by

Faculty Development Course



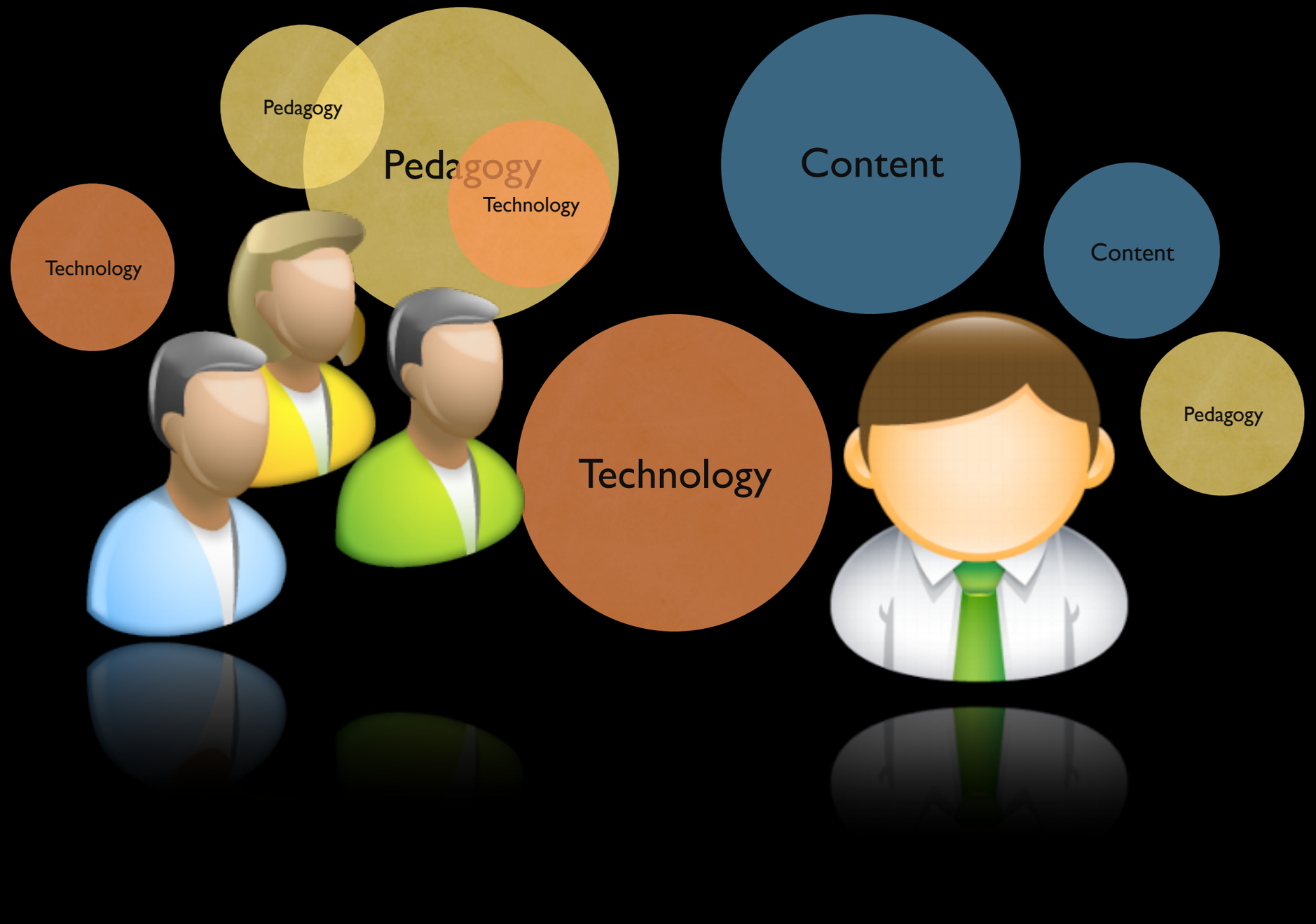
Designing online courses

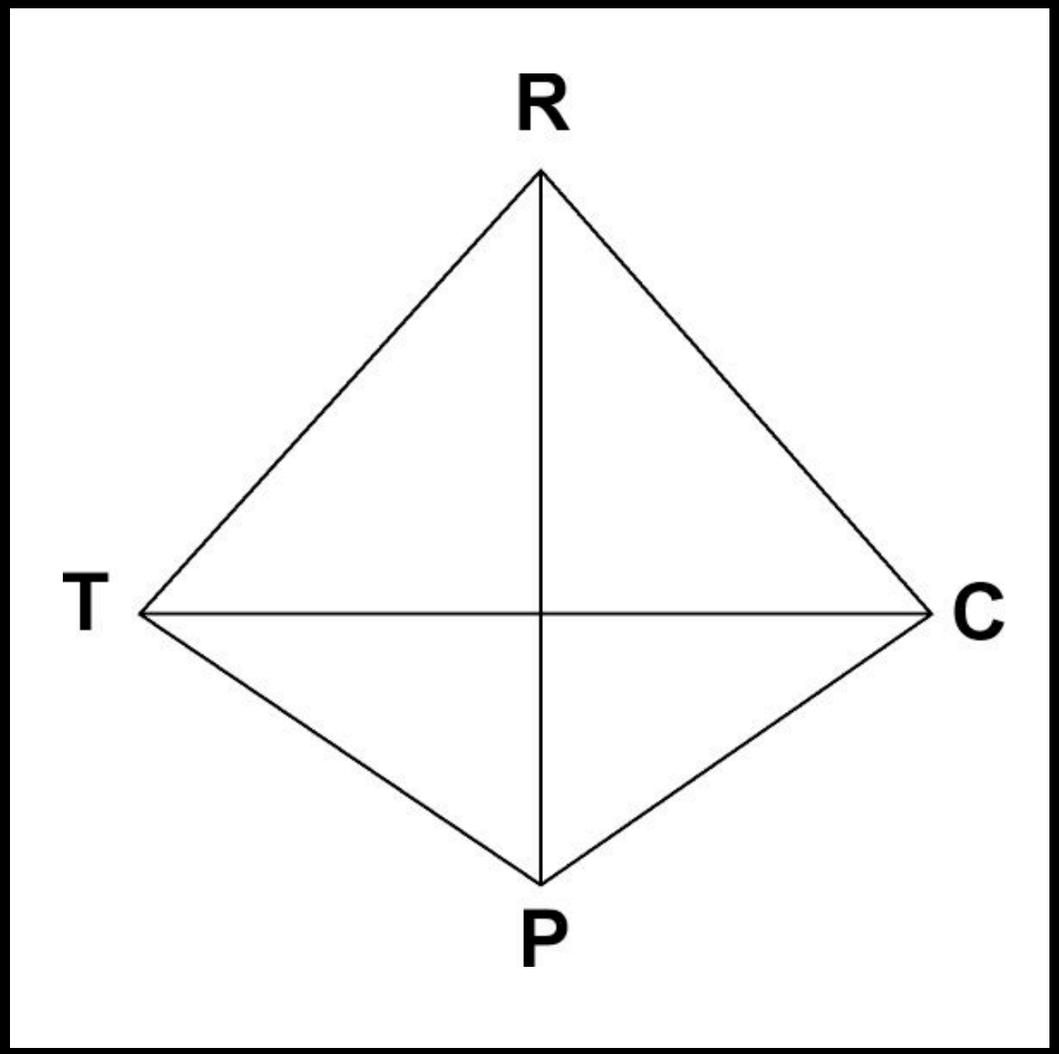
Prototype a section of the course

Pilot a section of the course

Redesign a section of the course

Looking at the data!



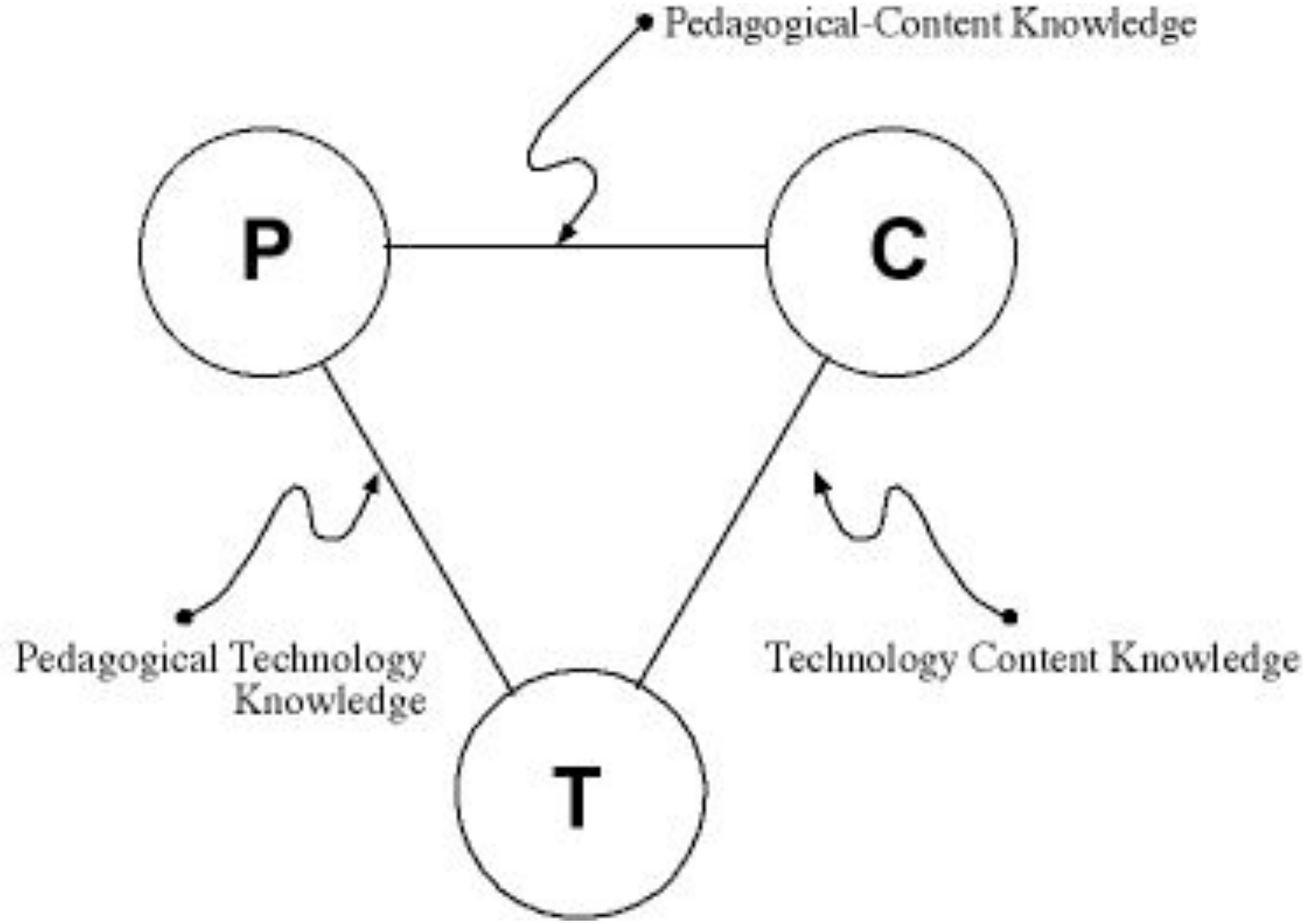


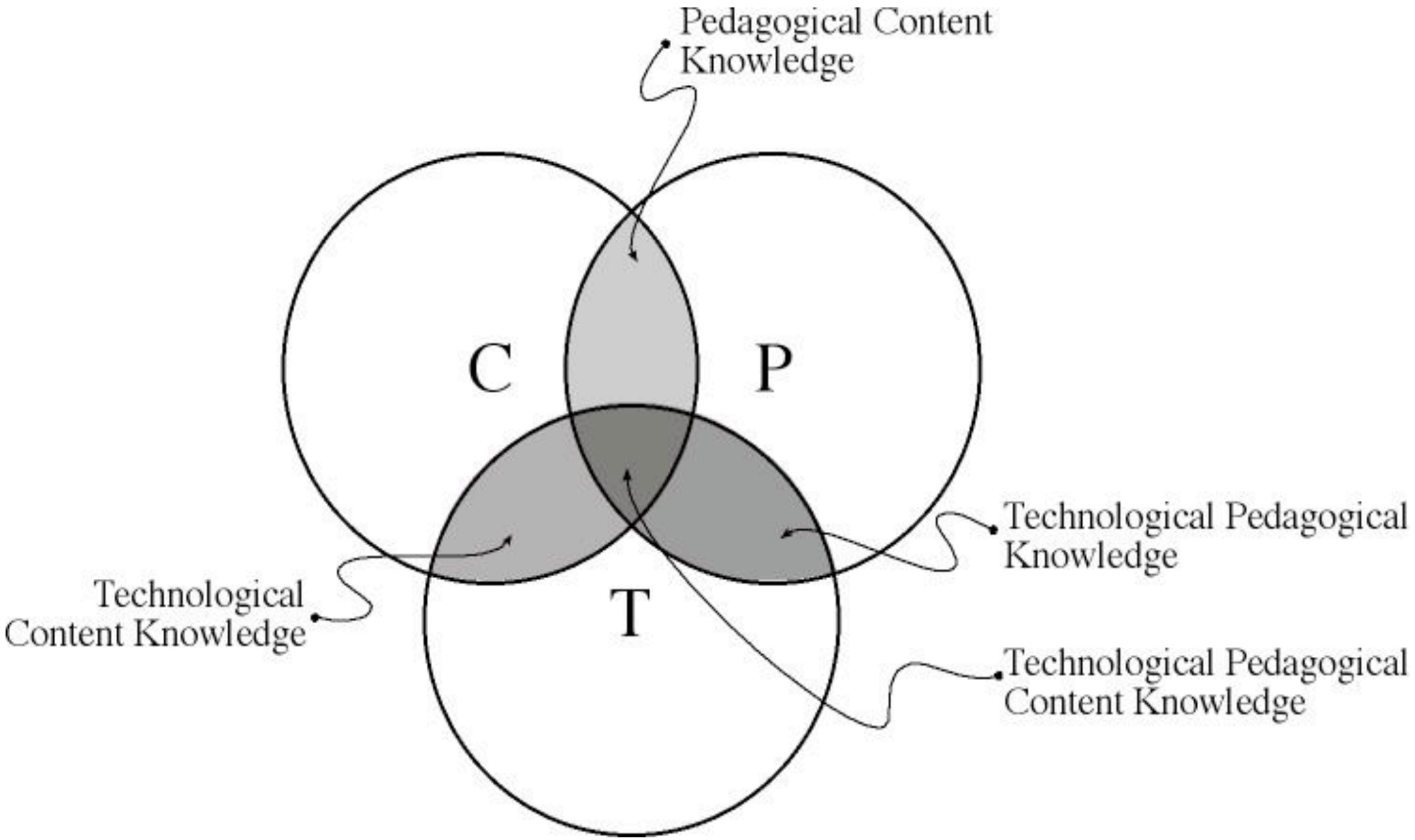
Content

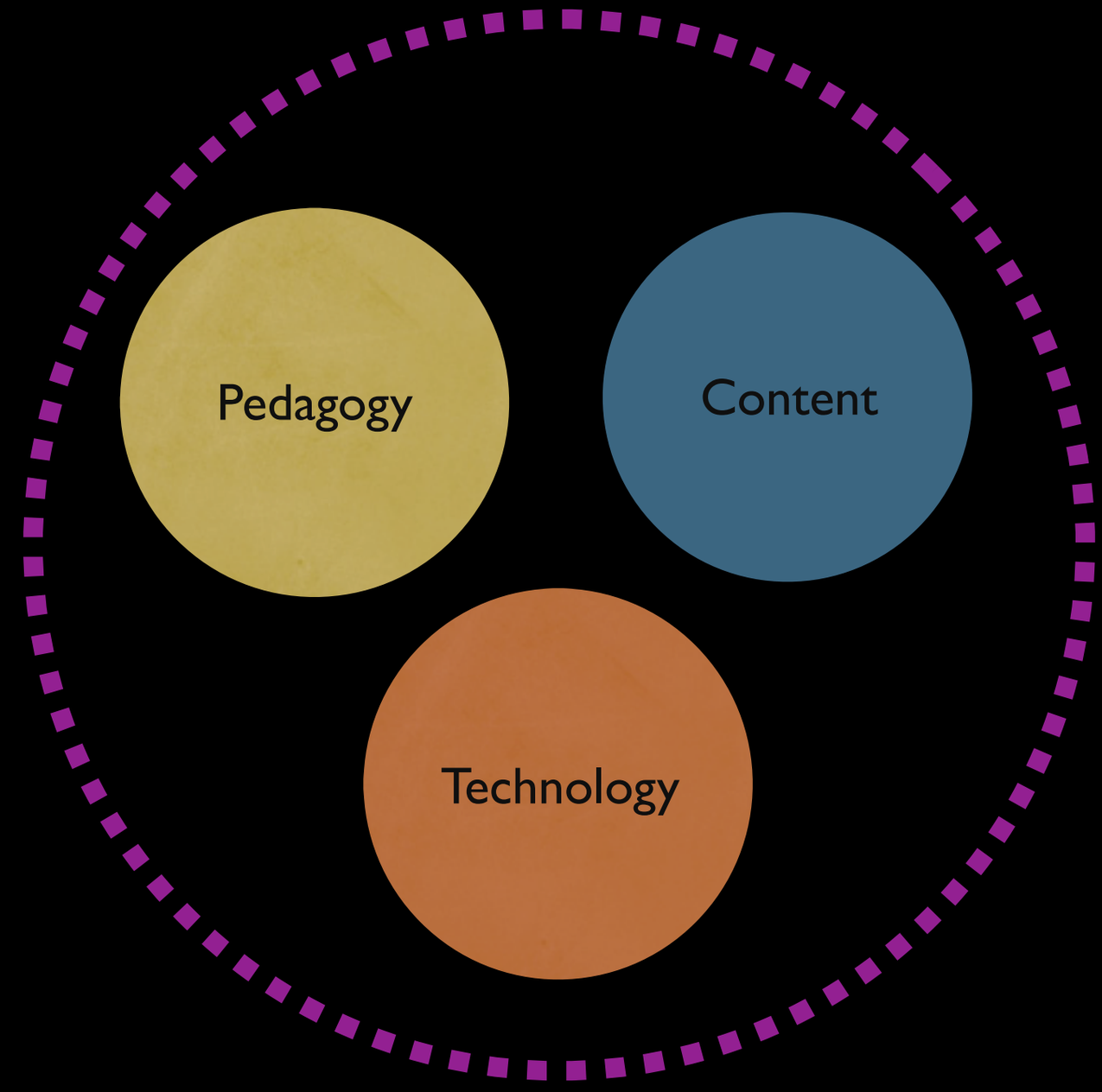
Pedagogy

Technology

Representations


Pedagogical-Content Knowledge
P
C
Pedagogical Technology Knowledge
Technology Content Knowledge
T


Pedagogical Content Knowledge
C
P
T
Technological Content Knowledge
Technological Pedagogical Knowledge
Technological Pedagogical Content Knowledge


Pedagogy
Content
Technology
Context

Measuring TPACK

Case studies of teachers learning about technology integration (Koehler et al. 2004)

Qualitative studies of conversations (Koehler, Mishra, & Yahya, 2007)

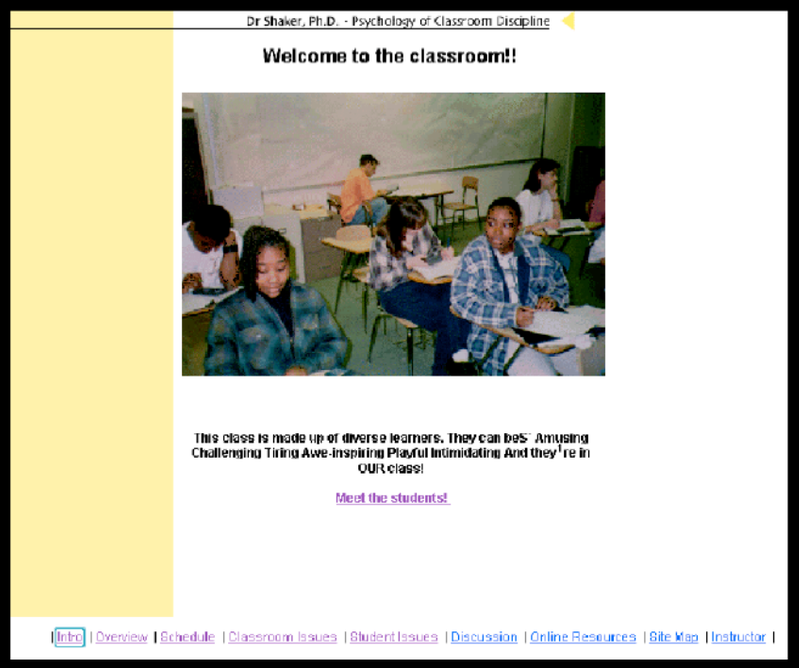
Survey measures (Koehler & Mishra, 2005) + ongoing

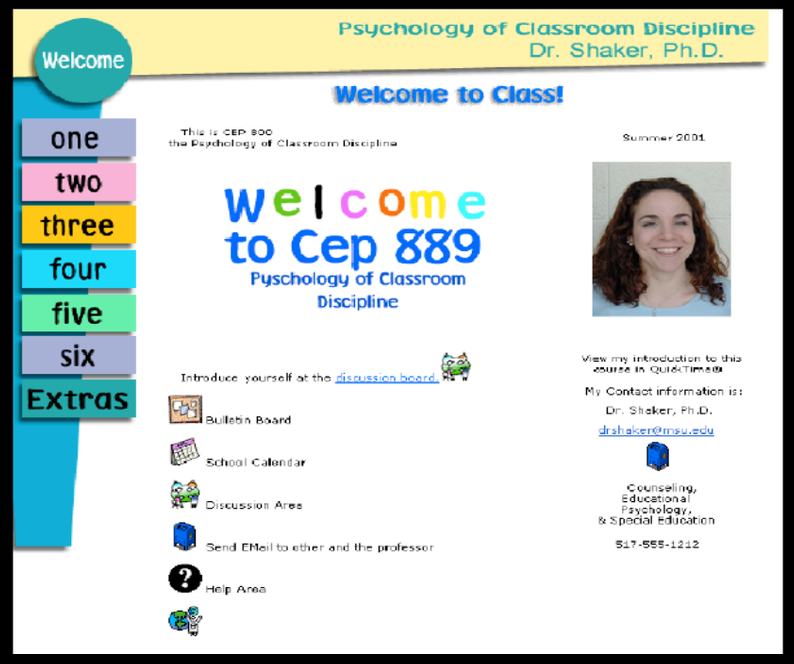
Studying teacher creativity (Deschryver & Mishra, 2008)

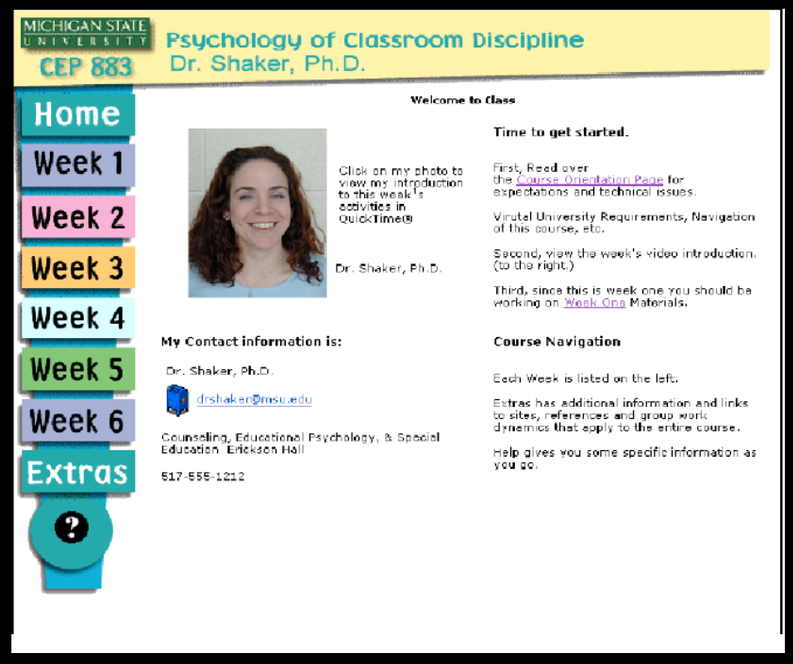
At other institutions...

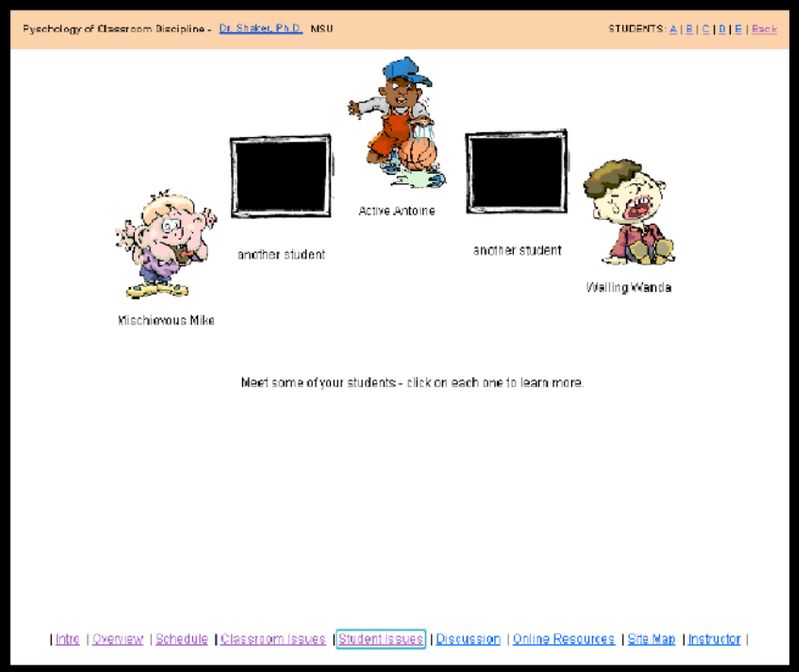
An early case study

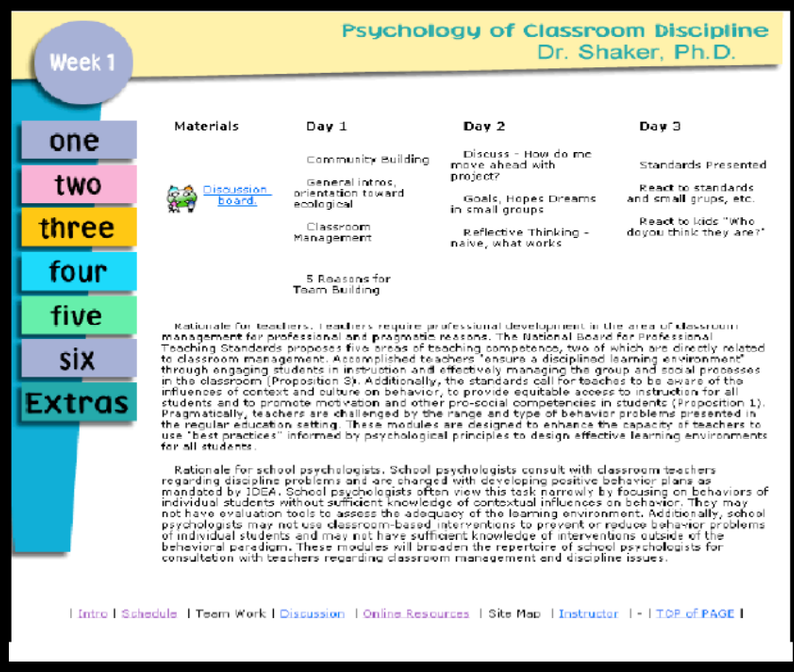
Koehler, Mishra, Hershey & Peruski (2004)

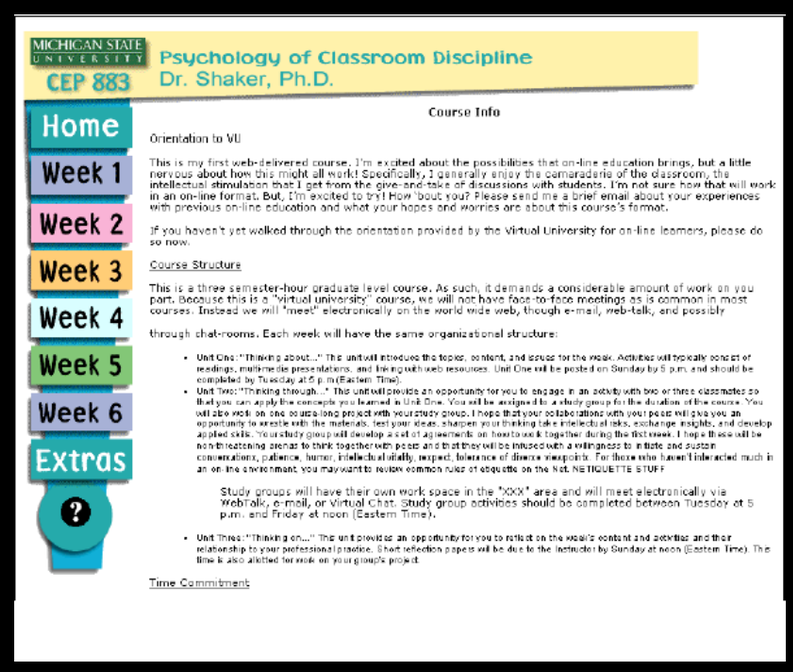






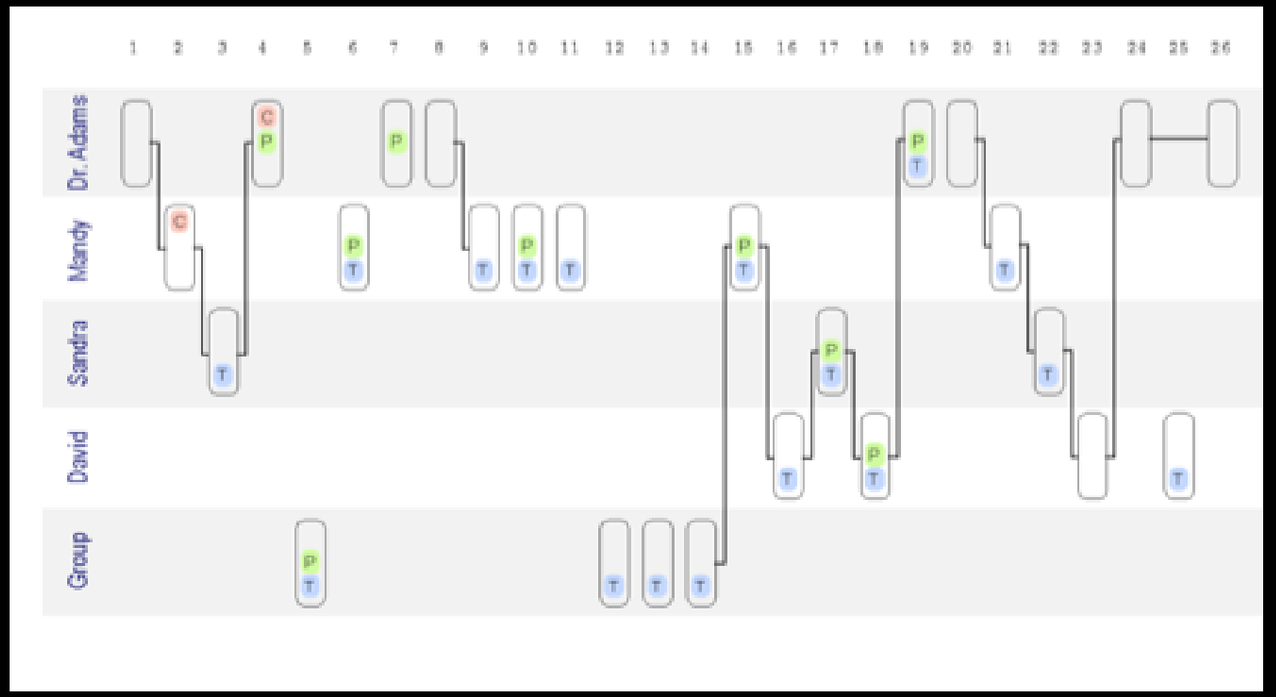


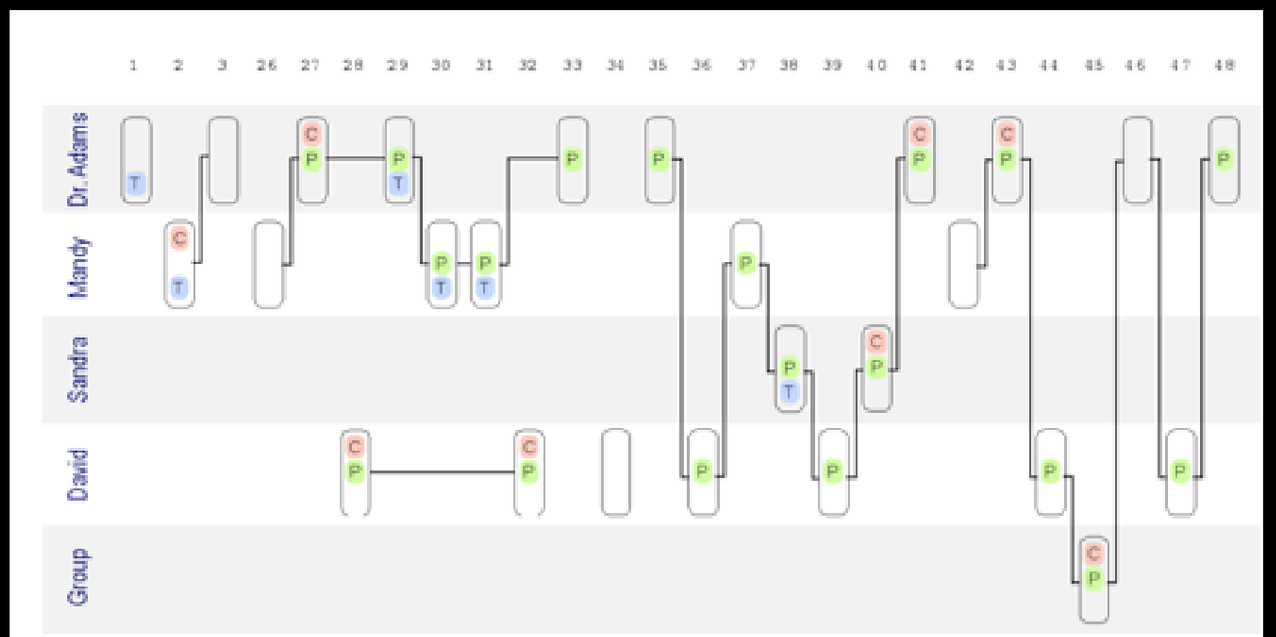




Studying Design Talk

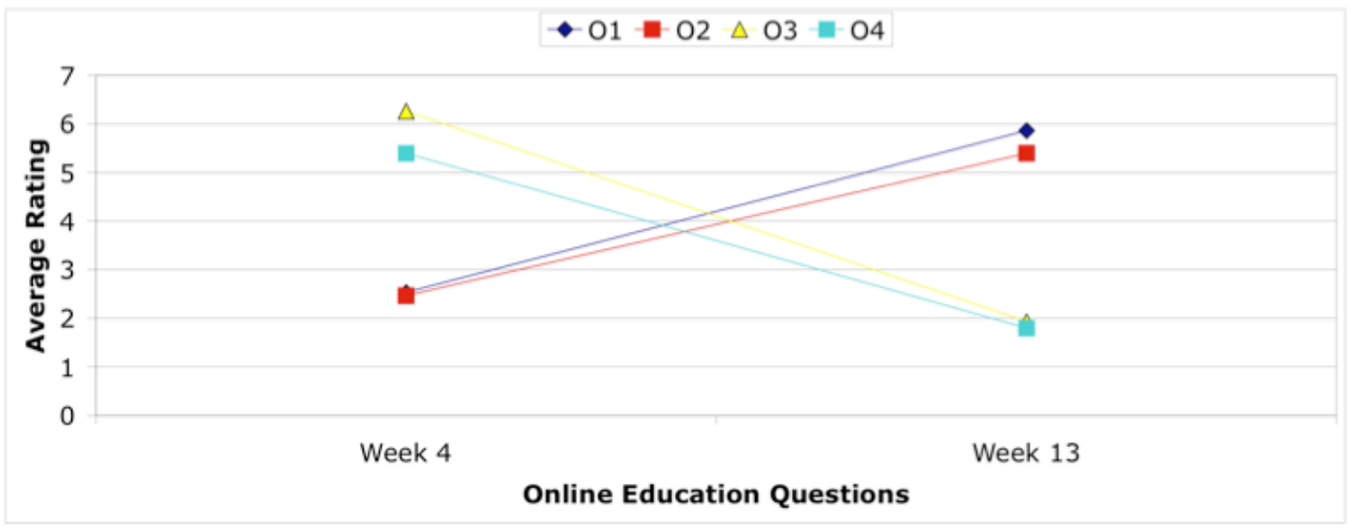
Koehler, Mishra, & Yahya (2007)





A Survey of TPCK Thinking

Koehler & Mishra (2005)

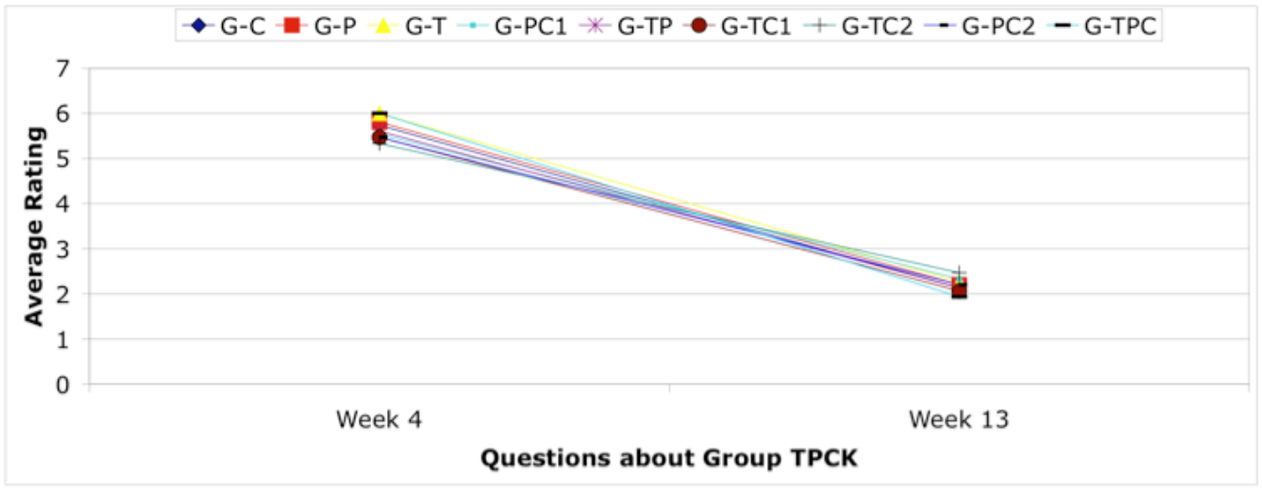


"Designing an online course requires changes in what we teach and how we teach"

More ...

"Our group has chosen technologies that fit the course content and the instructors teaching philosophy."

More ...



Ongoing

DeSchryver & Mishra, 2008

TPACK & Creativity

Google™

Mix and Match (Bricolage)

Domain Knowledge

Serendipity

Representation

Iteration

Interconnectedness

Transformation

Perspective

Expression

Provisionality

Pre-service mathematics teachers

Hampered by lack of knowledge of C, P & T

Developing a TPACK survey

In collaboration with Iowa State Universitiy

To be presented at SITE09 and AERA09

Also see:

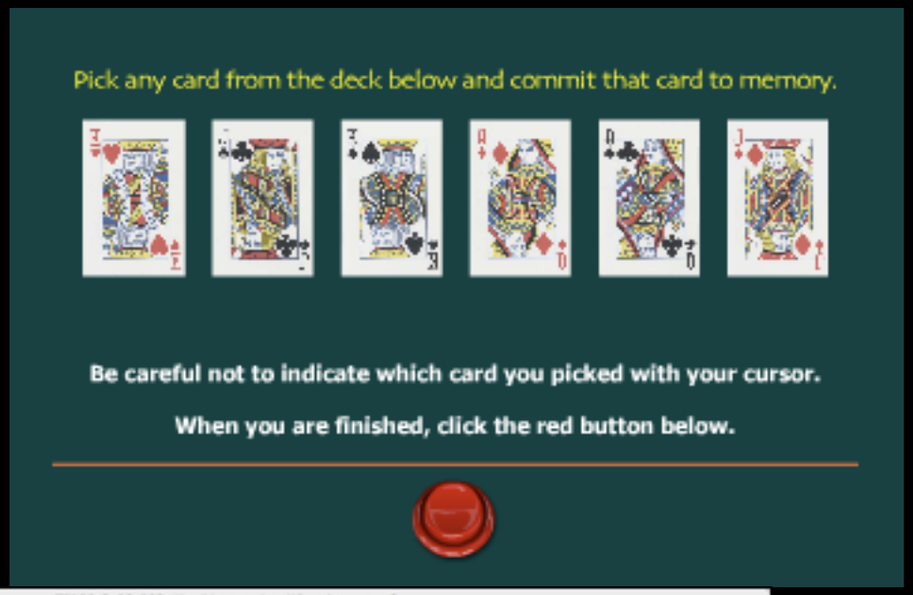
Banyas & Mishra (2008)
- affordances of learning management systems & instructor teaching philosophies

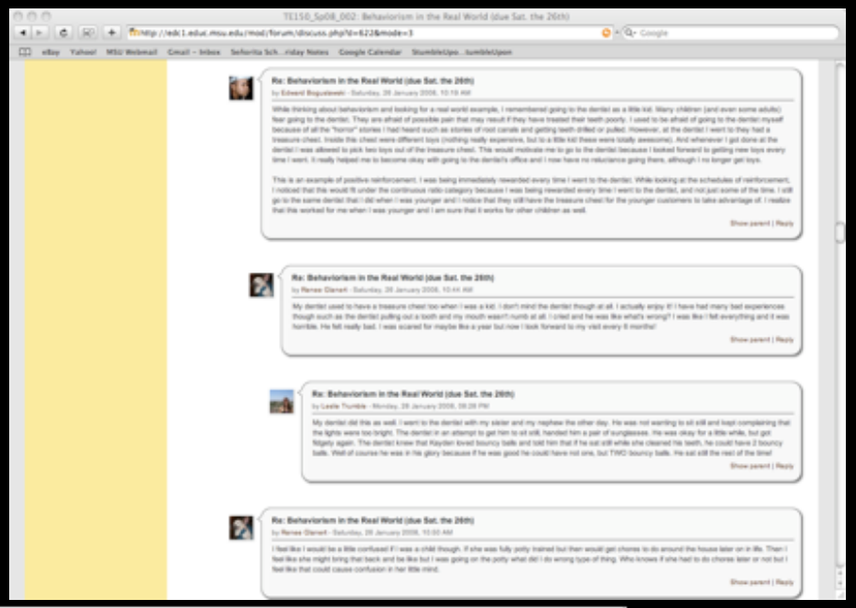
Peruski & Mishra, (2005)
- activity theory analysis of teaching online

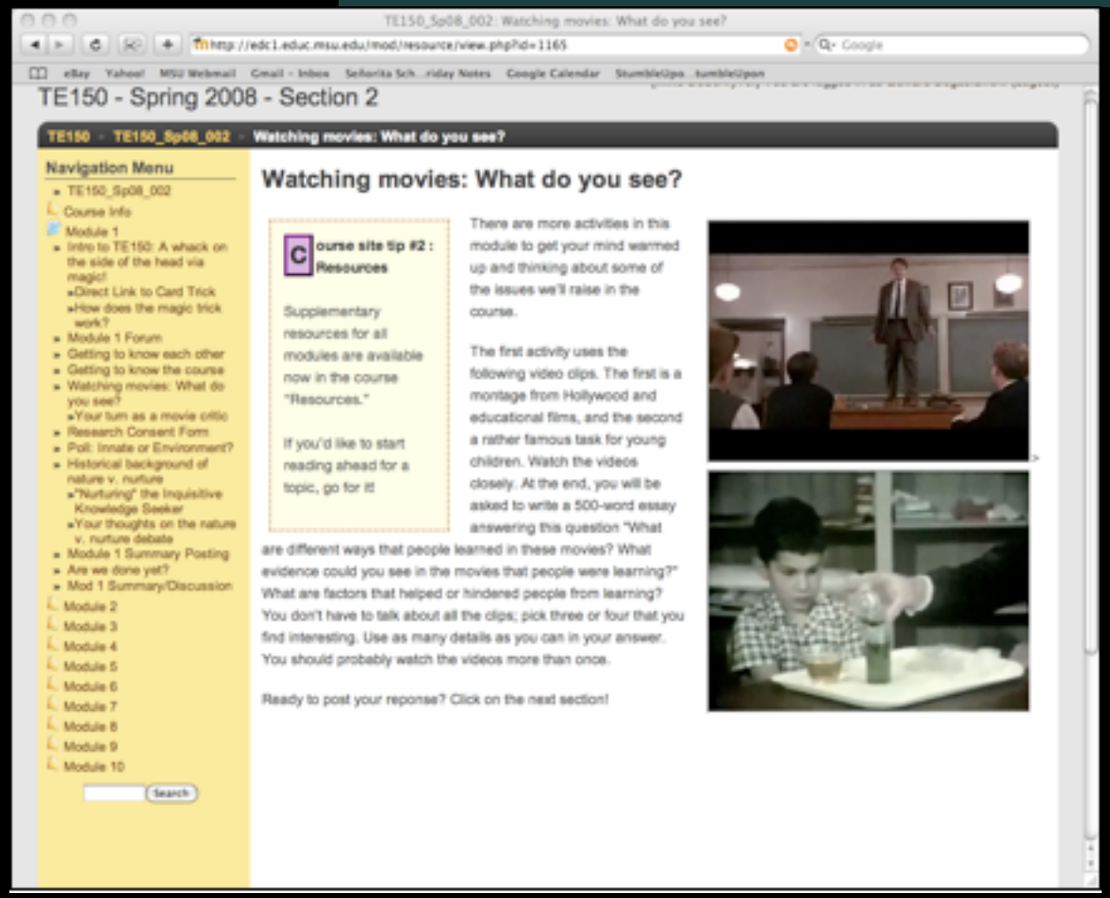
Dirkin & Mishra (2008)
- transactional relationship between beliefs, values and teaching with technology

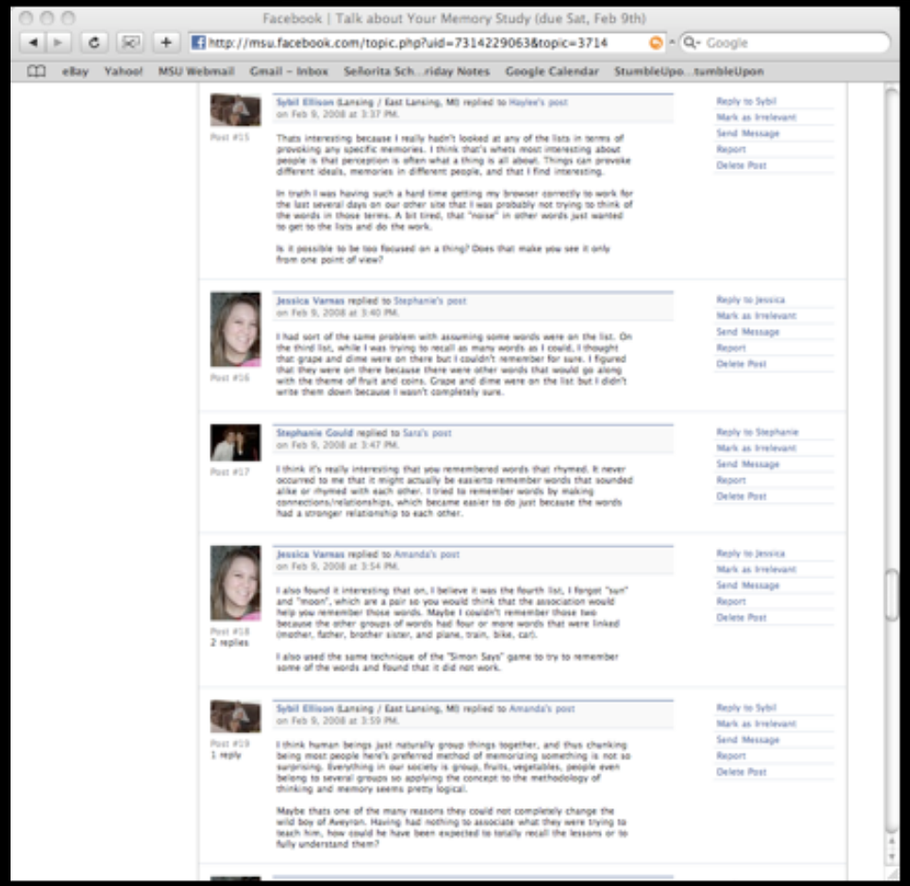
Walking the walk

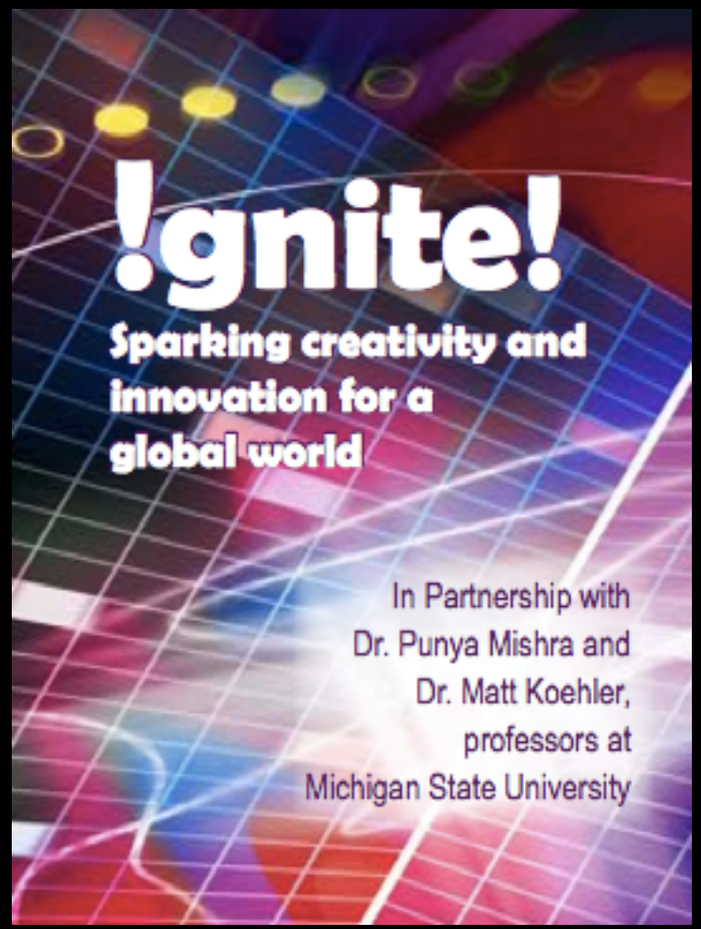
Reflections on learning
An online course!











Working with school districts for teacher professional development

Documenting & sharing examples of “pretty good” practice

Technology for Authentic Problem Solving

Keith Forton - Solution

Mr. Forton's solution is to use video capture to acquire video of simple and complex examples of motion. He then has the students use the software World in Motion to plot the and create a graph of the motion. This way students can see the translation of energy and other hard to conceptualize physics principles.

Review the problem.

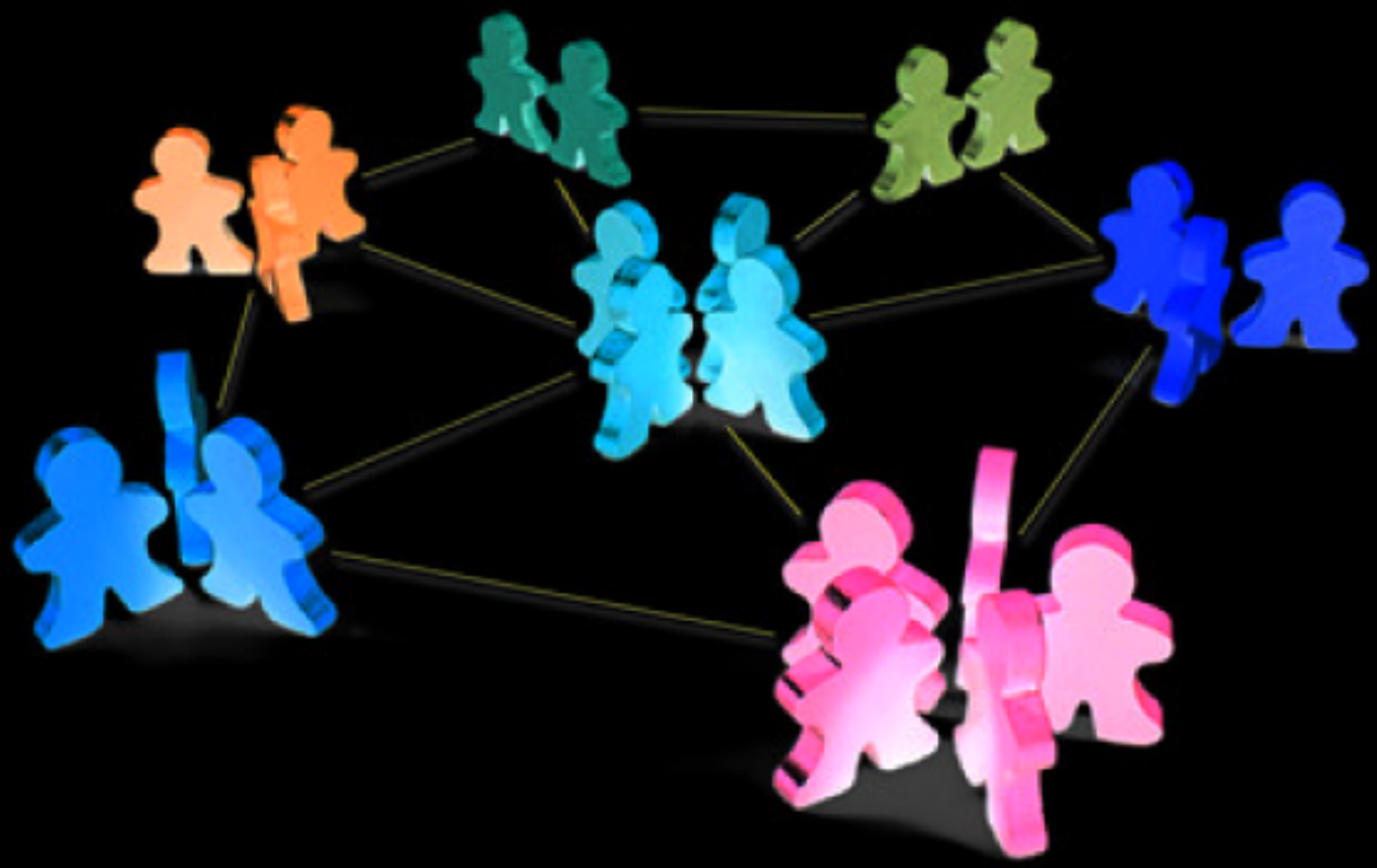
More Information

Related Videos

Tags

- High School
- Science
- Video
- Physics
- Graphs

Share



Spreading the word

The Society for Information Technology in Teacher Education (SITE), The American Association of Colleges of Teacher Education (AACTE), The National Associations of Childhood Teacher Educators (NACTE), National Council for the Social Studies (NCSS), Association for Mathematics Teacher Educators (AMTE), The Association of Teacher Educators (ATE), and the International Society for Technology in Education (ISTE).

What does the generative level of TPACK look like?

Repurpose technology

Working with constraints

Become curriculum designers

Using creativity

* Design principles
  - Integrated (T, P & C)
  - Spiral development (baby steps)
  - Changing teacher beliefs (Nudge)
  - Collaborative teams
  - Importance of creativity (repurposing/redesign)
  - Modeling / Humility
  - Iterative

So far...

Understanding technology

Teaching as lying at the intersection of C, P, & T (in specific contexts)

Going beyond use & integration

Three levels: mechanical, meaningful, generative

Some broad design principles

The future

Looking into the crystal ball

Looking forward

* Strategies for developing TPACK
    * Where do we start?
* Measuring TPACK
* Individual or group?
* Connecting to TE programs (PD/ degree)

In closing

Understand maps?

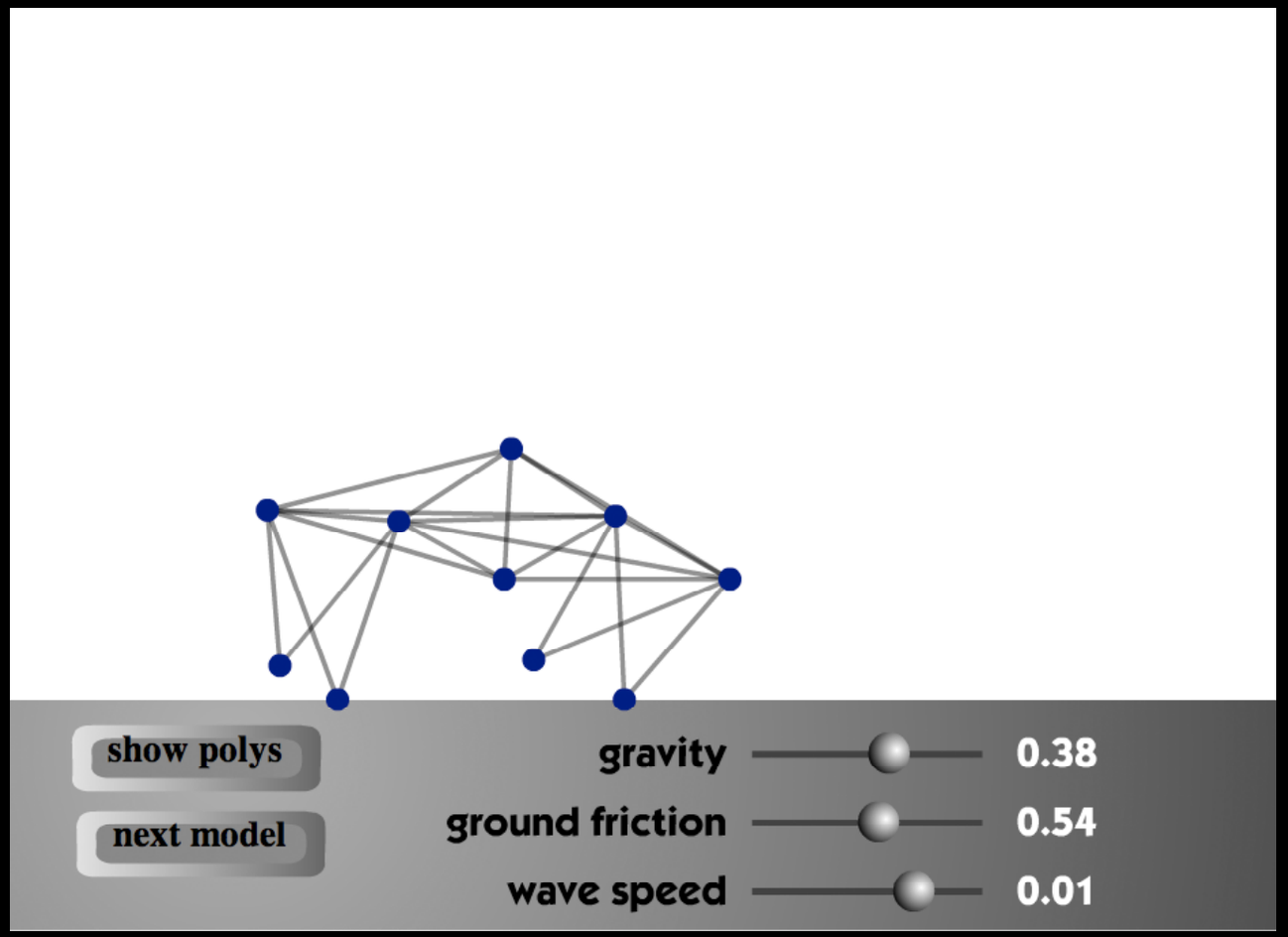
Go beyond concrete understandings?

Make maps more personal?

Solutions

KidPix,
Mapquest,
satellite photos,
virtual field trips
etc...

The transformative aspects of technology


show polys
next model
gravity
0.38
ground friction
0.54
wave speed
0.01

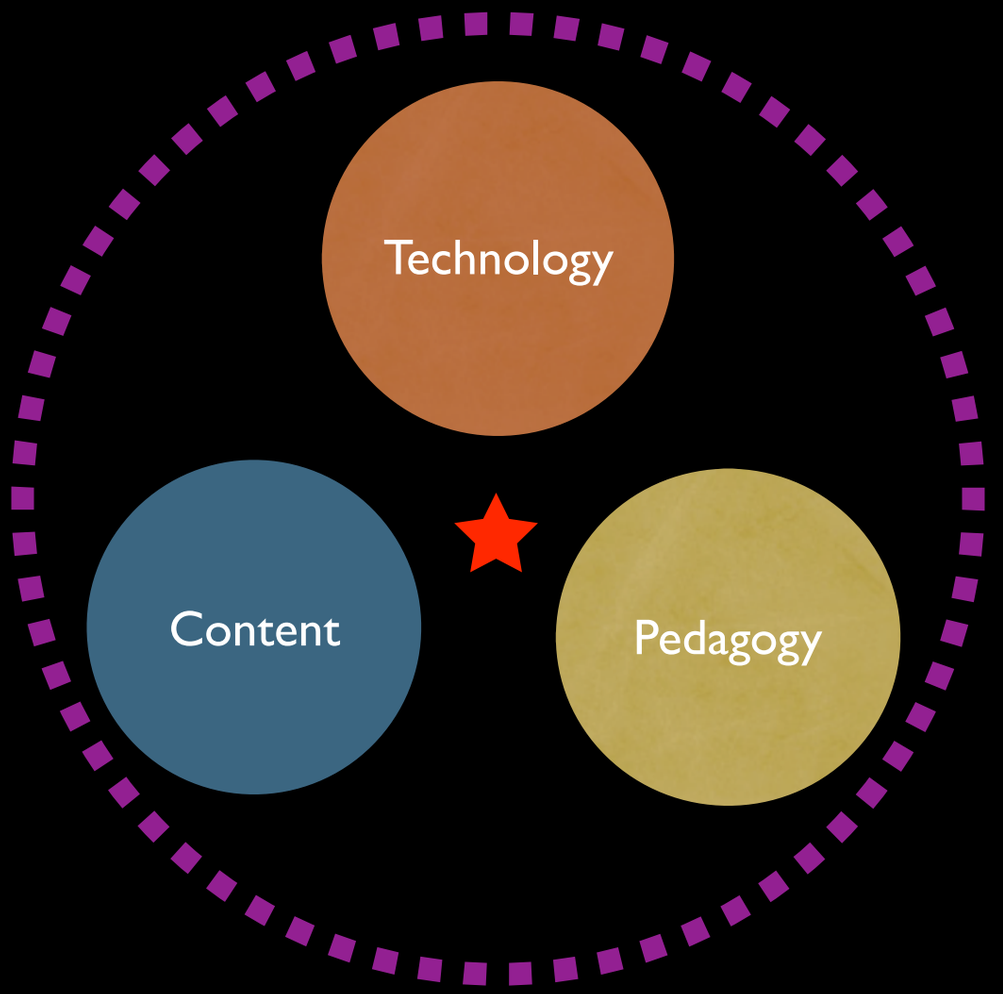
The walls between art and engineering exist only in our minds

The walls
between
Technology
Content &
Pedagogy exist only in our minds

The walls between Technology Content & Pedagogy exist only in our minds

If we are willing to play

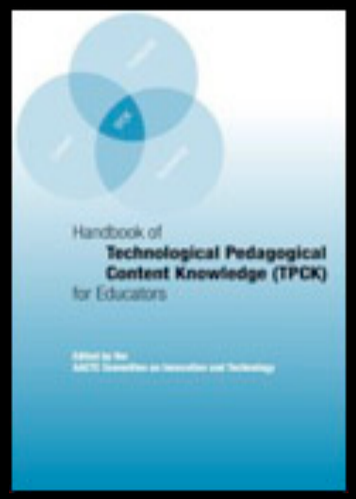
TPACK



Context

Coming up...

Looking at the world in strange ways



TPCK Handbook for Educators

www.tpck.org

Faculty development by design

We shall have to evolve
problem-solvers galore—
since each problem they solve
creates ten problems more.
— Piet Hein

punya@msu.edu
punyamishra.com