## Medical Education Through the Lens of SAMR: An Applied Workshop

Ruben R. Puentedura, Ph.D.



Pace of Innovation

Patient Safety

## Deeper Learning

Tech acts as a direct tool substitute, with functional improvement

**Substitution** Tech acts as a direct tool substitute, with no functional change

Redefinition Tech allows for the creation of new tasks, previously inconceivable

Modification Tech allows for significant task redesign Transformation

## Augmentation

Ruben R. Puentedura, As We May Teach: Educational Technology, From Theory Into Practice. (2009)

## Augmentation Tech acts as a direct tool substitute, with functional improvement

### **Substitution**

Tech acts as a direct tool substitute, with no functional change

### John E. Hall PhD

directions to interdigitate with the mposin filaments. The Z disk, which is composed of flamentous proteins different from the actin and myoria filaments, passes crosswise across the myofibill and also crosswise from mobility to mychioril, attaching the myohbrils to one another all the way across the marcle fiber. Therefore, the entire muscle fiber has light and cark hands, as do the individual myof brils. These bands give skeletal and cardiac muscle their striand appearance.

The po		'ber) th
lies betw	Ask authors for slides for: From	Vhen th
nusde fi	Ribosome to Sarcomere - Titin	sine field
the lengt		is length
the actin	Dynamics in Striated Muscle Cella	1958, 35
the tips	Michael Gotshardt, Franziska	stap or
anothes	Rudolph, Judish Huettemeister,	apable a
gereratir	Katharina da Sliva Lopes, Lily Yu,	
ItoFa	Nora Bergmann, Claudia Fink, Eva	LCB1

The side-by-side relationship between the myosia and actin filameans is maintained by a large number of flamentous malecules of a protein called anii (Figure 5-3). Each thin molecule has a molecular weight of about 3 million, which makes it one of the largest protein molecules in the bady. Also, because it is filamentous, it is very springs. These springy titin molecules act as a framework that holds the myosin and actin filaments in place so that the contract le machinery of the saccinese will work. One end of the thin molecule is elastic and is attached to the 2 disk, acting as a spring and changing length as the sarvomere contracts and relaxes. The other part of the title molecule seshers it to the myosin thick filament.

332

Guyton and Hall Textbook...Medical Physiology E-Book

The title malecule also appears to act as a template for initial formation of postions of the contractile flaments of the surcomere, aspecially the mycein filuments.

Acto pro samera	Z SOR
context. Each this move disk to the M line. Part dosely associated with ment, whereas the re- apringy and changes to contracts and releves.	oute extends from the Z of the ttin molecule is the myosin thick fila- at of the molecule is

Sarcoplasm is the intracellular Field between Myefibrils. The many mohibrils of each muscle fiber are suspended side by side in the muscle fiber. The spaces between the myofibrils are filled with intracellular fluid called savoplass, containing large santities of potassium, magnesium, and phosphate, plas multiple sentria exercises. Also mesent are tremendous aurobers of miteshould that lie parallel to the myofibrils. These mitochondria supply the contracting myofikells with large amounts of energy in the form of adenosize imphasphate (ATP) formed by the mitochondria.

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WEATST \*

### 12-22 AM

In some in conservations. Conservating the array conservation is an extent of the second sec STLC: has been well studied. Protochrome molecules such as archeoreans and group can be institution, which change their startment and properties renew Hy by light institution, are expected to be applicable to photo-outletes of biomatomachines. Treviously we have demonstrated that STLC analogues compared of archeorearen (ACTAR) or spinoryma (SPA,DA) inlibit EgS ATTase series/g and motive neively photo recorded your UV and visible light instalation. Mercover, licka cell drivion was photo-regulated with ACTAO. In this study, we have which to study the optimum conditions to regulate the function of ErS with the relaxedermic inducions we have overheaved. function of Eg5 with the photochromic inhibitors we have synthesized. In the results pH and onic strength dependent effect of the inhibitory on the ATPase activity and Egd diven microwhole gliling. At pHES, SP APA snowed signif-icant efficiency to centrel ATPase and notor activities as an inhibitor that has a photo-soticiting system.

### 2/05-Pos Board 84,8

2.00-Foi Board 04.2 Tight Caupling between the Heat Dissipation and Malocular Moloc's Transpart Properties in Nanopalifurian Study State Wannesh Hwang, Chaupheng Byten. Computational Sciences, Koron Institute for Advanced Study, Secol, Koron, Rapublic of. We report a theoretical analysis showing tight coupling between relevity V, diffusion coefficient E. and the heat function of knowin-1 motor protein which is remaindered of the necess surprising observation of enanced diffu-sivity of institutions, 2020. From the spanning function of the Landow (Bioled et al., Network 2020). From the spanning function of V. D. and itsel disjonation in et al., Nature, 2010). From the quantification of V, D, and next dissipation in terms of rate constants using periodic one-dimensional hopping model, we forms of the contains using periods one-amendoting hipping model, we found: (D) neroaces in the form of 2014 weige polynomial of V when V is suggested by the increase of ATP concertention; (ii) the increase of diffs-sivity with the heat production is a natural outcome of systems in non-opalibitium swody states; (iii) the sumogetic cert for determining the positions of a kinesin-1 with a given precision to close to lower bound.

### Cytoskeletal Assemblies and Dynamics

### 2107-Pos Board 5429

Javerson Bourg SALS
 From Ribesting to Sarcomore - Titls Pynamics in Stringer Muscle Cells
 Michael Gothardt - Franciska Radobly', Julith Huetemeister -Karhaine da Shya Logovi, Lily Yu<sup>2</sup>, Nora Regressio, Chada Fink<sup>1</sup>, Eva Wagney, Stechana Lohandt, Carol Geogorie<sup>2</sup>,
 <sup>1</sup>Man Dulbrard, Centur in Nelevalia Medisine, Bellin, Brunany,
 <sup>2</sup>University of Arterna, Tucsen, AZ, USA, "Coeffingen University, Geoefficient Generale."

Goetingen, Cernarav,

Red Matsodaiae", Gareti Jonez", Alexander Stesinadsky . "Mechanobology Institute, Singapore: Singapore, "King's College London, London United Kingdom. Endoarmes represent a special class of integris-mediated redlamiters adhesione Indocenes represent a special class of integris-mediated cell-mitrs adhesion formal hyperinguing and matrix degrading cells. Fans, ave demonstrated that in macrophage-life TifF1 cells and in illochlasis simulates to pooles pole somes, down-regulation of ACD1 hysiKXA, and by pharmacological introletes led to striking polosome dimination. Treatments that induced polosome formation increment the level of CTDA-band ABF1. Forthermore, siXRA Intellection of the ARD1 GET ADNO also resulted in deamatic polosome inhibition. ADNO was found to volocalize with the idlocive rings of polo-some while ABE1 was localized to volocalize with the idlocive rings of polo-ments while ABE1 and localized to volocalize with the idlocive rings of polo-ments while ABE1 and localized to volocalize whether the results of polo-ments while ABE1 and localized to volocalize the results of polosomes while AXFI was localized to vesicular structures transiently connecting polosome rings. Inhibition of ARFI led to an increase in RhoA GTP levels and triggered assembly of myssin-ILA filaments in THF1 cells that resembly and trippered assembly of reyosin-ILA diaments in TBF1 cells that resemble increases-like equation typically observed in the bubbans, while the sup-proxime of regresselD. Assessed pediconse formation despite AEF1 infibities finally, expression afcomsinatively notice AEF1 in fibrotions induced ferma-tion of public pediconset processors, active tich pushtabline coincider with ma-trix degradation sites unal containing proteins of the pediconse uses by individual threadmain entry. We conclude that AENO ARET regulater fermation of polo-mena by inhibition of Eheringtonin II and promotion of actin core assembly.

2111-Peo Board B-21 Local Paines of Risos Activation Assemble Polarized Network Architectures for Efficient Actionacolis Constractility Francois & Robin/, Ionafan M. Michanol, Edwin M. Marrol, "Developmental Biology Department, Institute for Biology Paris-Scienc, Basis, Funce, "Molecular Genetics and Cell Biology, University of Chicago, Constra, U.S.

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Cheaps, E., USA. Spatiolemooral patterning of actemyosia contractility plays a key role in cell and tissue morphogenesis during only development. In orthyonia cells, acto-myosin arrays are highly-dynamic structures that remodel on a timescale of 10s repeats renys in thighly-dynamic structures that remodel on attime code of 10 of scrouds, through a combination of local activity cain sumever and tapic spatial reductilation of flammas and motors surrowly proposin activity or actin polymerization. Because of these dynamic and active properties, contrastility is complex and interneically self-organizing. We used the C. elegans early subbys to understand how cells pattern 'non-gen-eration through local modulation of self-organized contrastility, forusing en-reduction through local modulation of self-organized contrastility, forusing en-reduction through local modulation of self-organized contrastility, forusing en-reduction through local enclosure and polytoperiod contrastility.

pulsed contracility in the C. ciegous embryo.

publical contractility in the C: cirggine entryo. We combined two-color flucture entrying live single-molecule imaging, particle thesing, image malyris, and numerical modeling to take apart the mechanisms of public initiation and termination. Our results demonstrate that the mechanical component (advantiset) playal little rule in galax initiation or truninations, and that the process was usually generated by Action and Myonic transvers. In our system, autocatacybe RhoA advanteentrectatment is respon-sible for public initiation, while the delayed recruitment of a RhoA, inactivator

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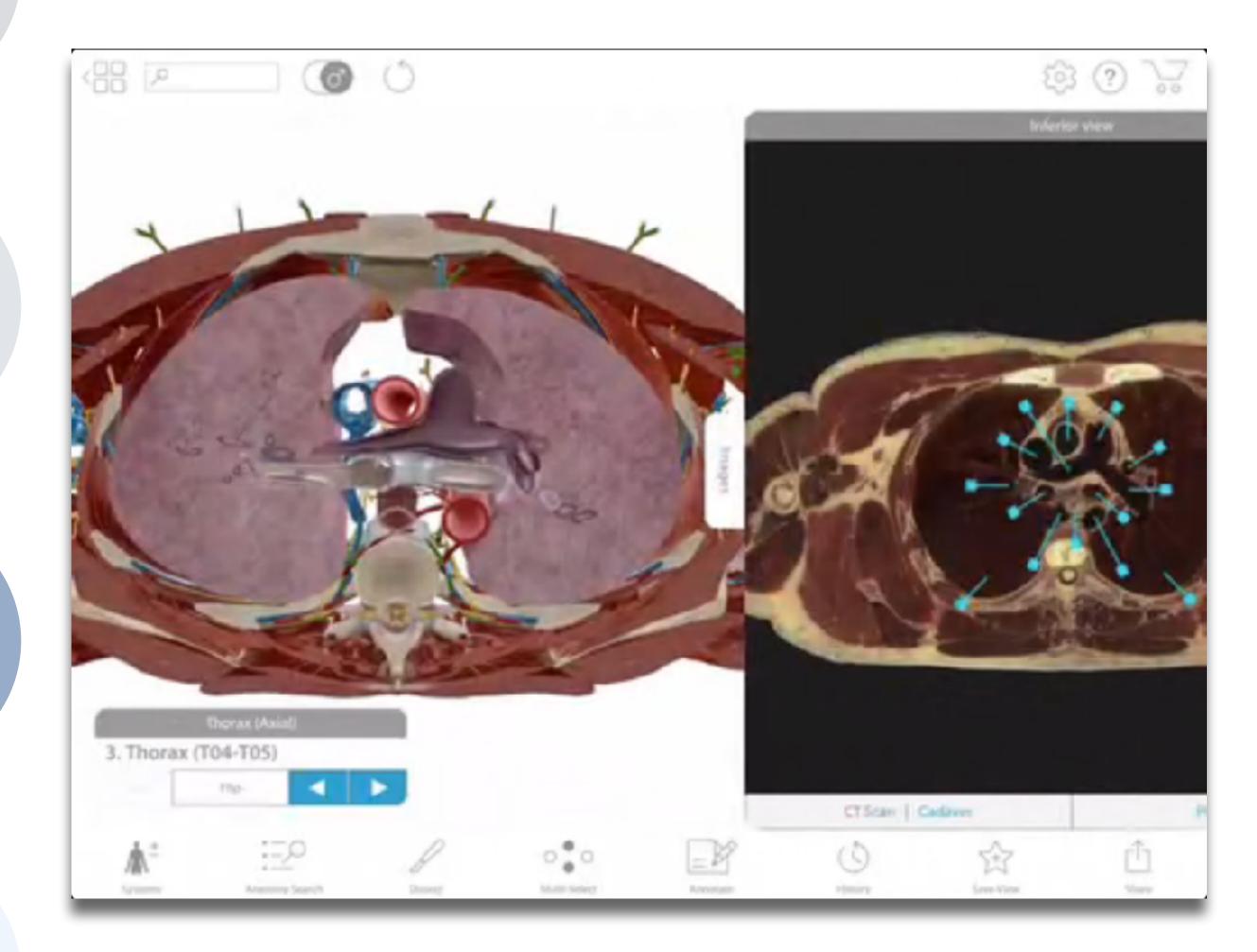
### Nisha Mohd Badiqi, Zi Zuzo Lioui, TingTing Jungi, Cheng han Yui,

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## Modification Tech allows for significant task redesign

### Augmentation

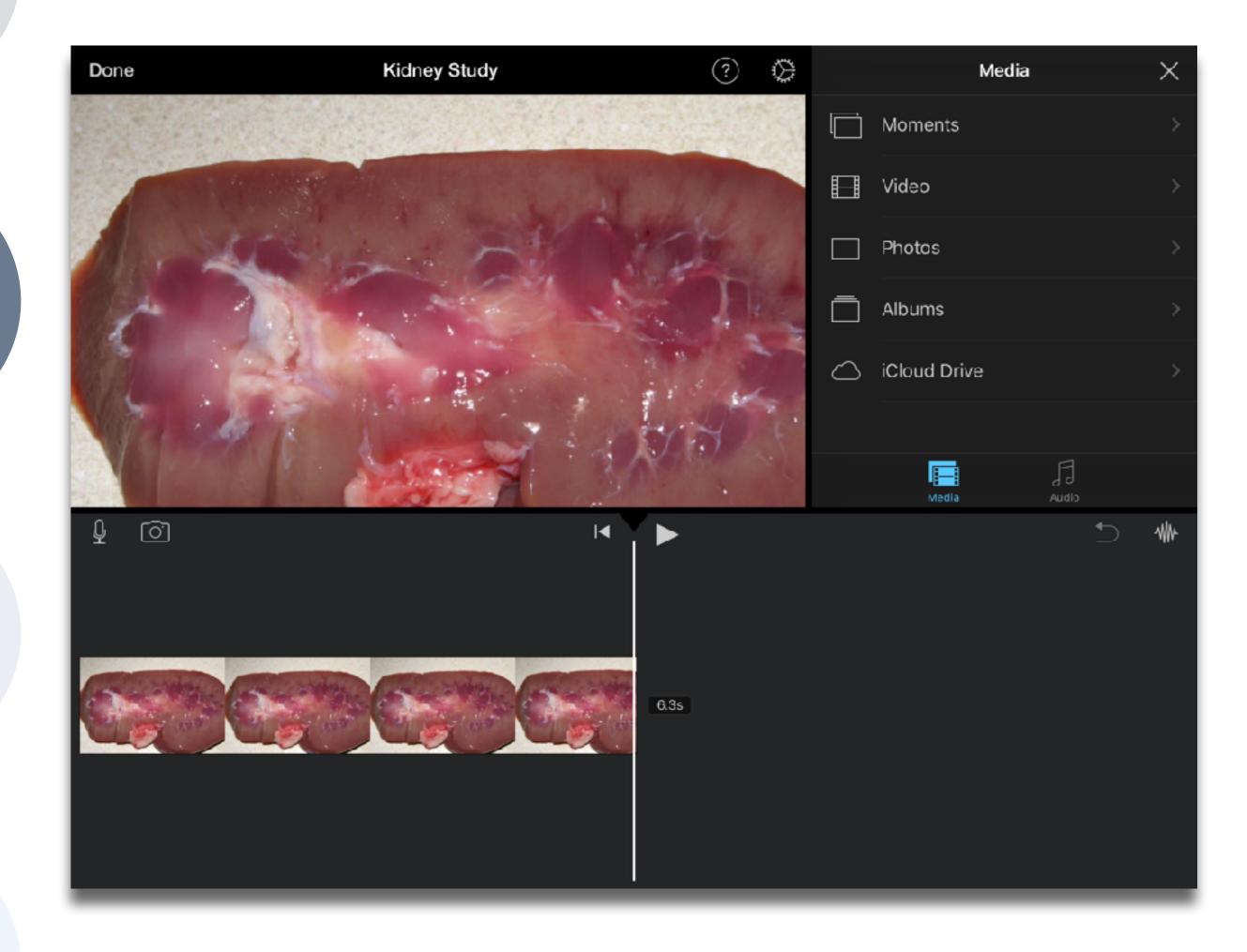
Tech acts as a direct tool substitute, with functional improvement



### Modification

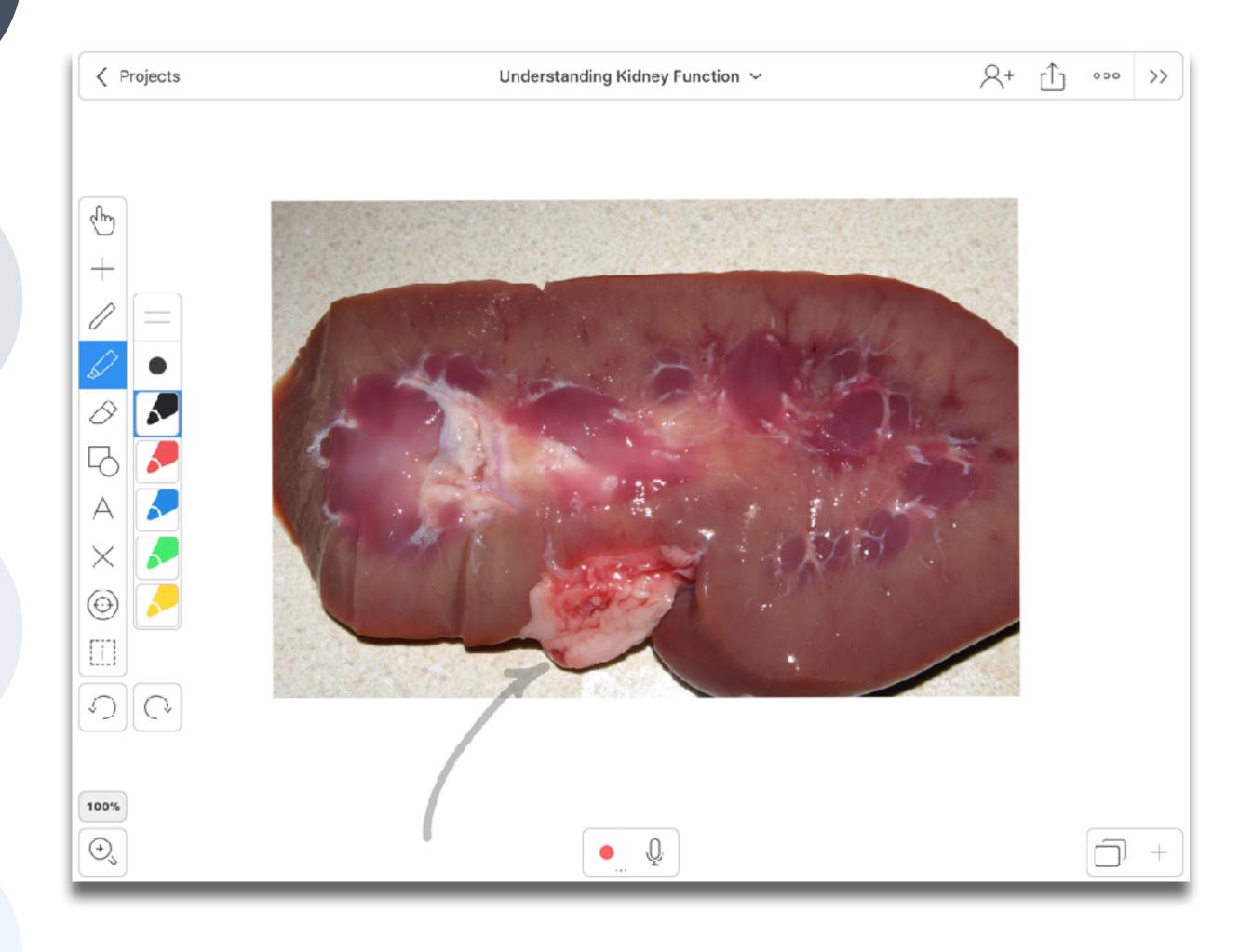
Tech allows for significant task redesign

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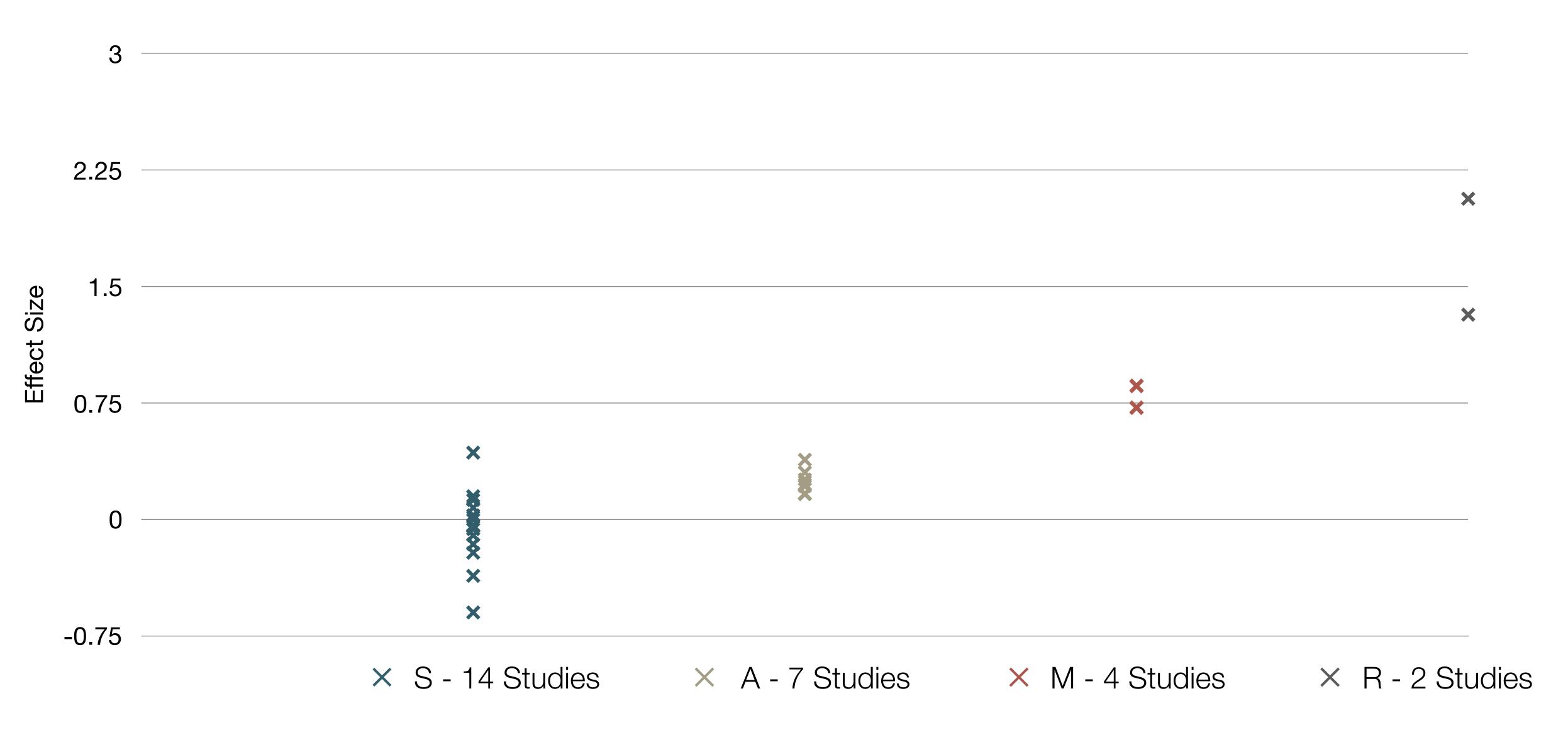


# Modification Tech allows for significant task redesign

## Augmentation Tech acts as a direct tool substitute, with functional improvement



## SAMR and the Use of Tablets in Education

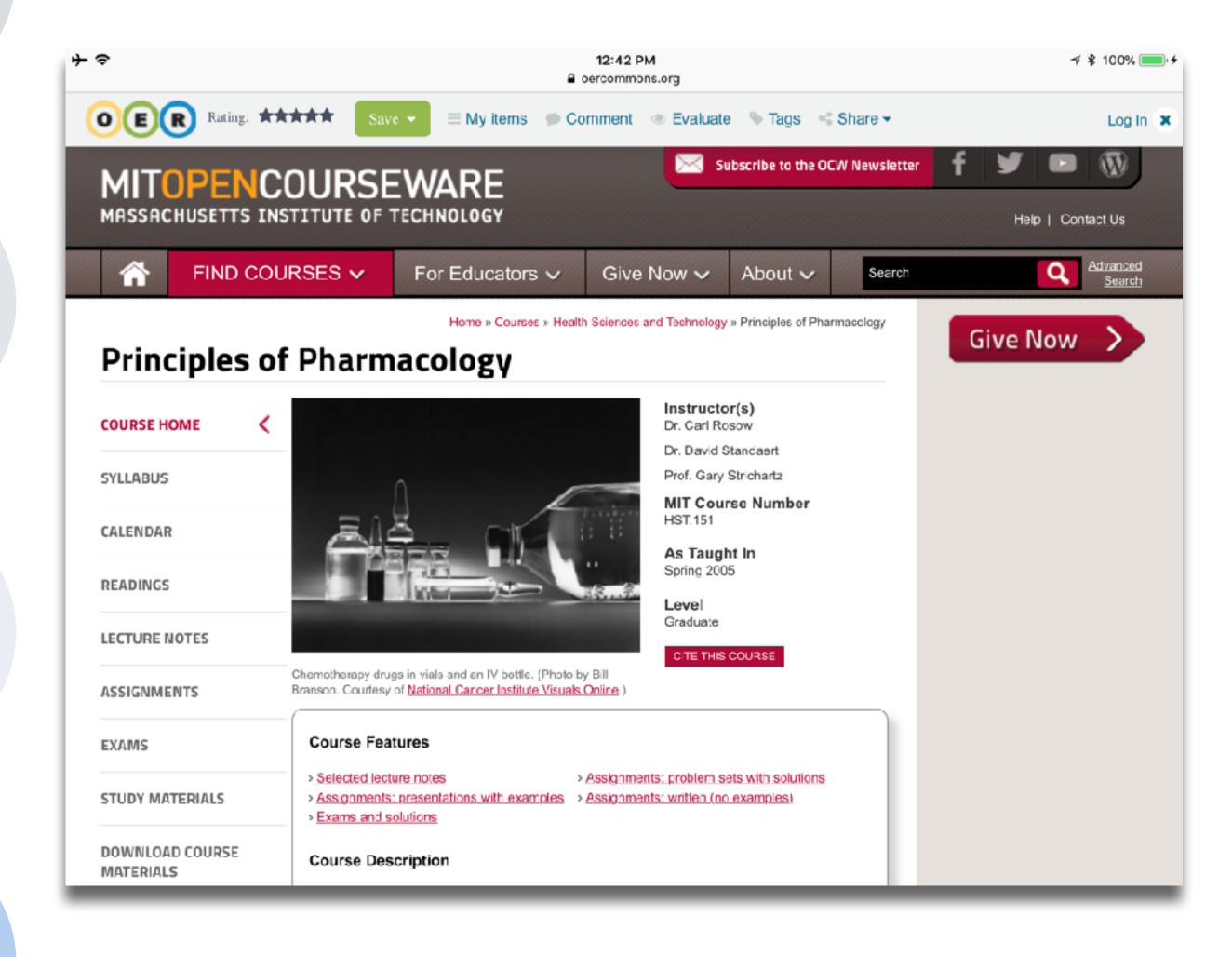


Tamim, R.M., Borokhovski, E., Pickup, D., Bernard, R.M. & El Saadi, L. "Tablets for Teaching and Learning: A Systematic Review and Meta-Analysis." Commonwealth of Learning (COL) (2015).

## Modification Tech allows for significant task redesign

## Augmentation Tech acts as a direct tool substitute, with functional improvement

### **Substitution**

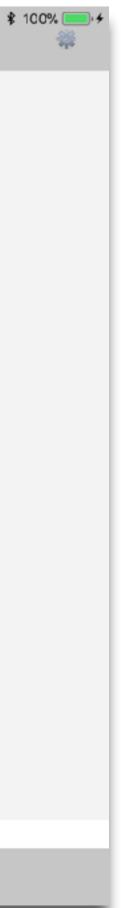


## Modification Tech allows for significant task redesign

### Augmentation

Tech acts as a direct tool substitute, with functional improvement

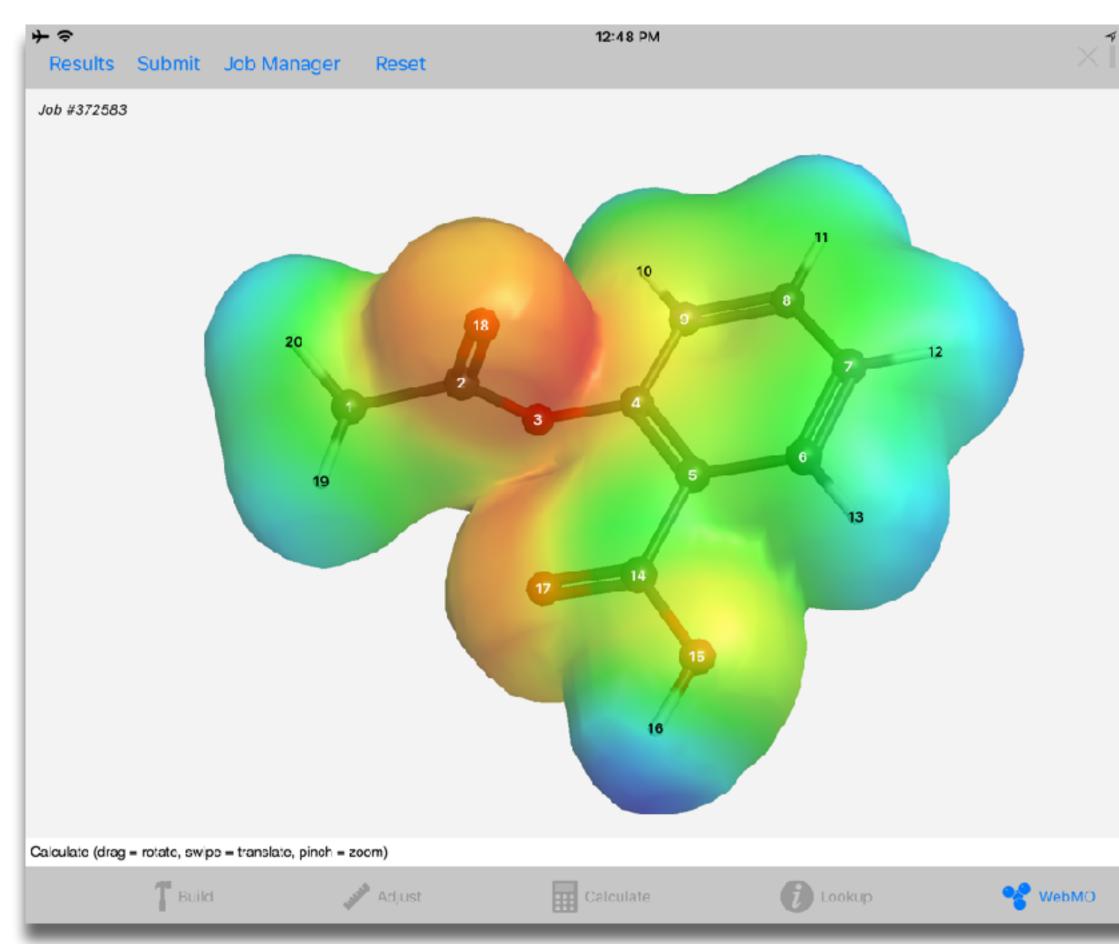
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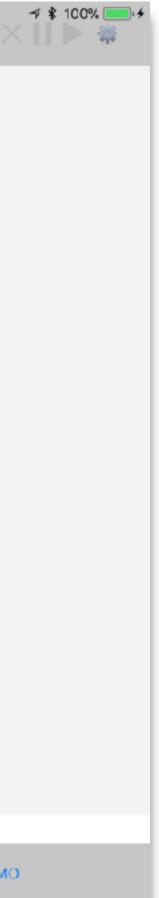


### Modification

Tech allows for significant task redesign

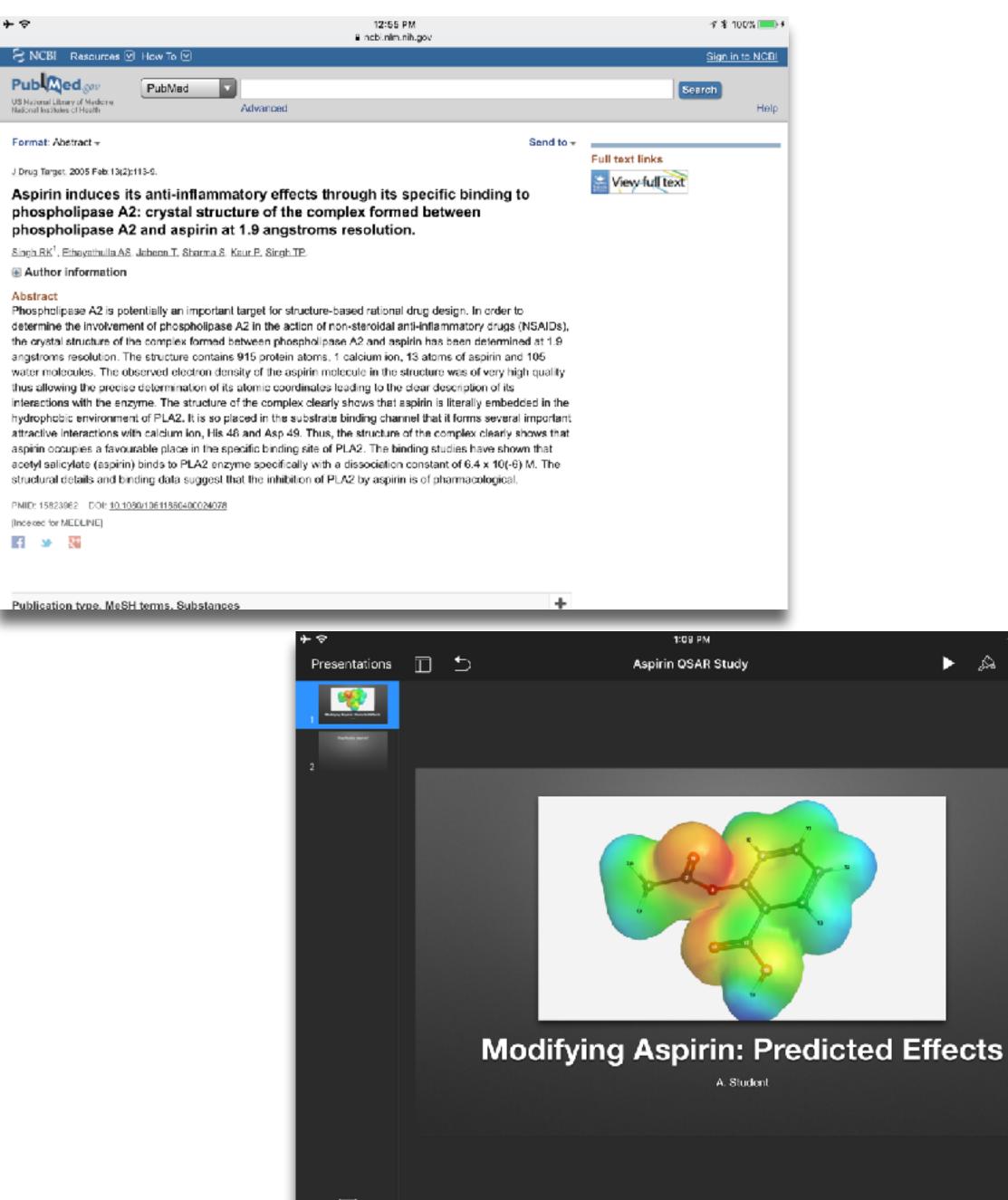
Augmentation Tech acts as a direct tool substitute, with functional improvement





# Modification Tech allows for significant task redesign

## Augmentation Tech acts as a direct tool substitute, with functional improvement





Social	Mobility	Visualization	Storytelling	Gaming
200,000 years	70,000 years	40,000 years	17,000 years	8,000 years
<image/>				
	Ruben R. Puentedura, "Technology In Educati	on: The First 200,000 Years" The NMC Perspective Series: Ideas	that Matter. NMC Summer Conference, 2012.	





## Bookmarks

## Discussions

Social

Blogging

Telepresence







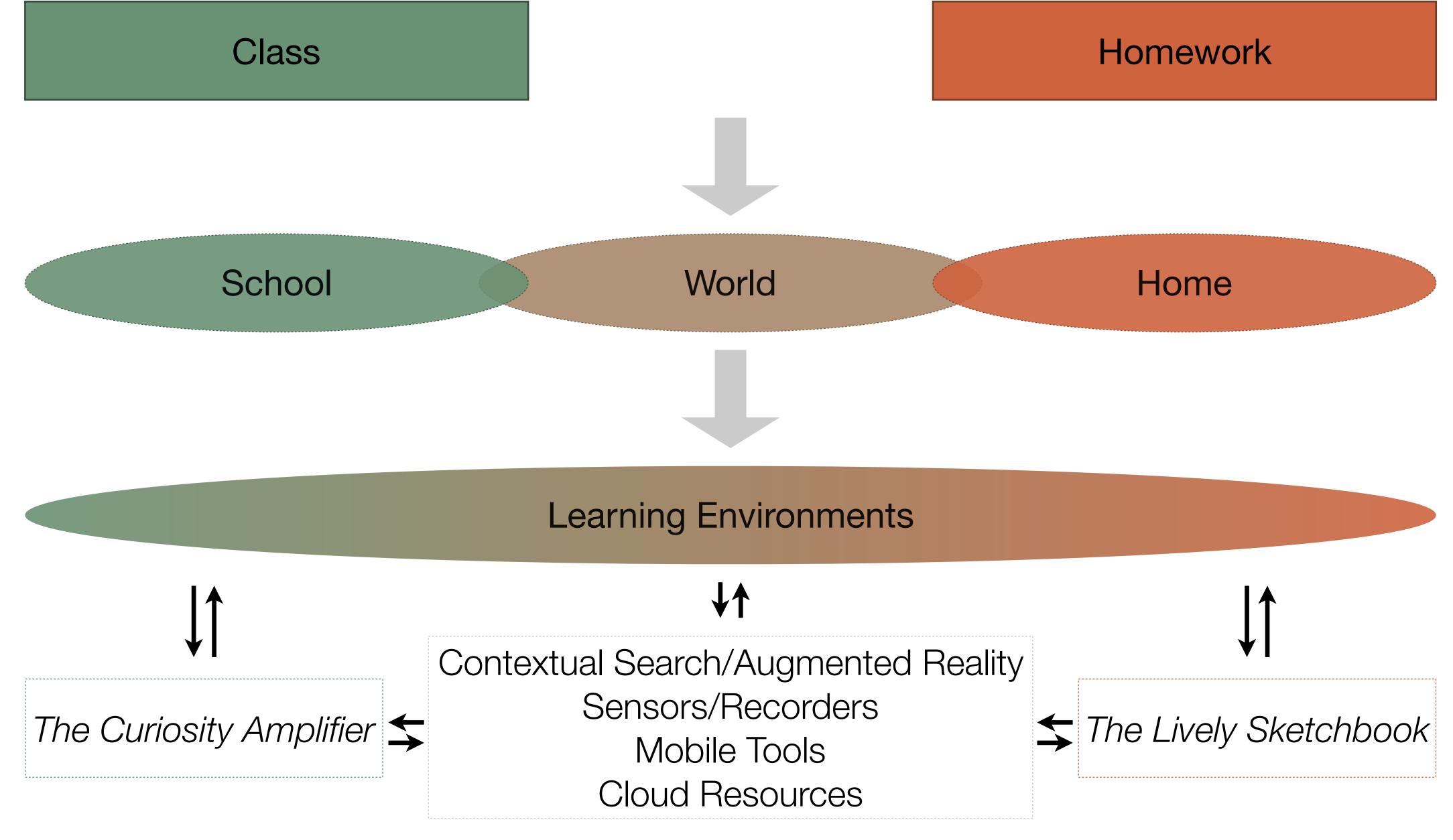




# Microblogging

Wikis

File Sharing



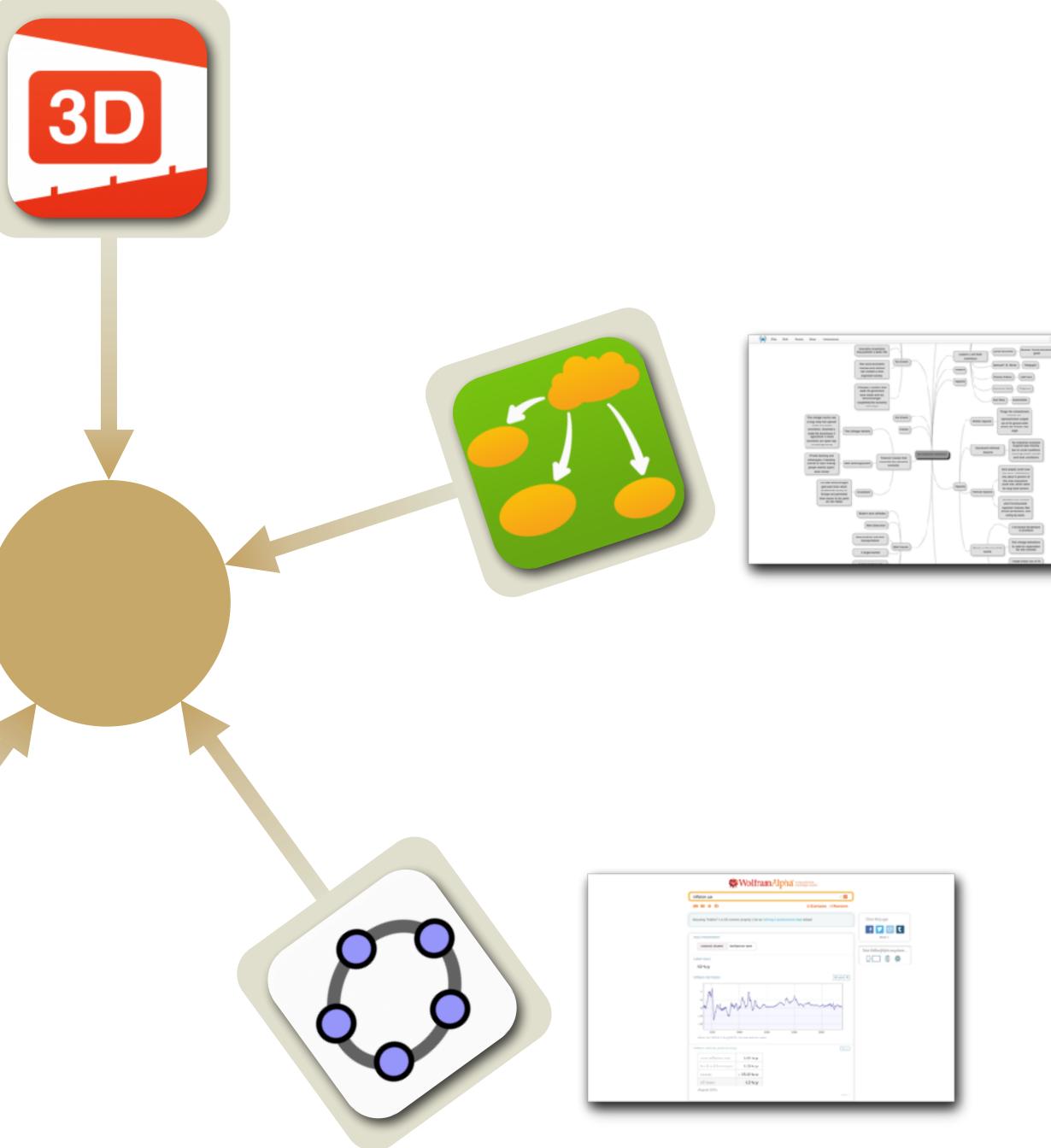




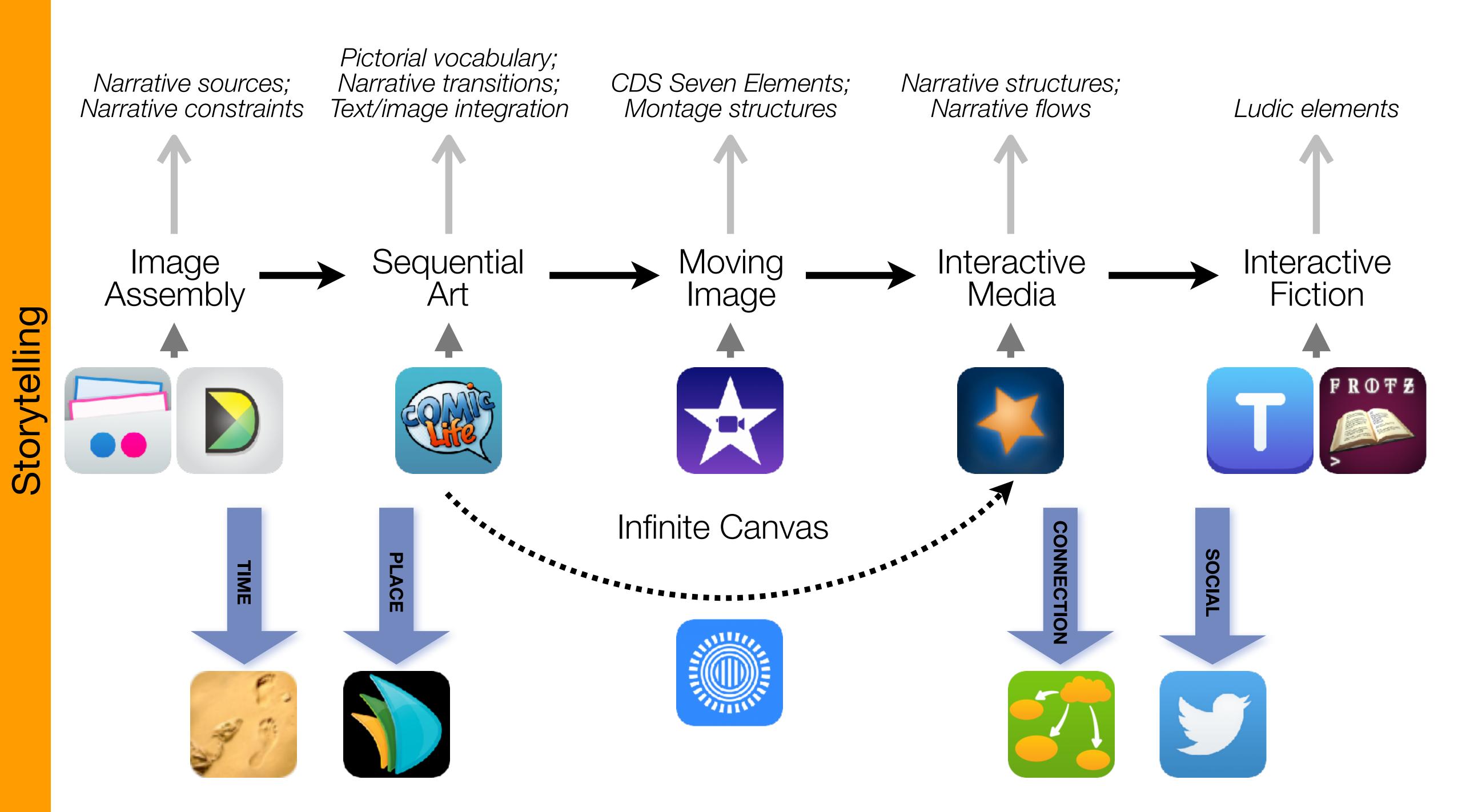












# Formal Definition of **Game** (Salen & Zimmerman)

"A game is a system in which players rules, that results in a quantifiable outcome."

# engage in an artificial conflict, defined by

The EdTech Quinte		
Social	Commur	
Mobility	Anytime, /	
Visualization	Making	
Storytelling	Knowledg	
Gaming	Feedback L	

## et – Associated Practices

- nication, Collaboration, Sharing
- Anyplace Learning and Creation
- g Abstract Concepts Tangible
- ge Integration and Transmission
- Loops and Formative Assessment

## Modification Tech allows for significant task redesign

## Augmentation Tech acts as a direct tool substitute, with functional improvement

### **Substitution**

Tech acts as a direct tool substitute, with no functional change

Kenneth A. Kiewra, "Students' Note-Taking Behaviors and the Efficacy of Providing Instructor's Notes for Review". Contemporary Educational Psychology, v10 n4. (1985)

### ●●●●○ AT&T LTE

 $\times$ 

### 5:07 AM

5 4 …

### Redefinition

Tech allows for the creation of new tasks, previously inconceivable

### Modification Tech allows for significant task redesign

### Generalize patterns

Augmentation Tech acts as a direct tool substitute, with functional improvement



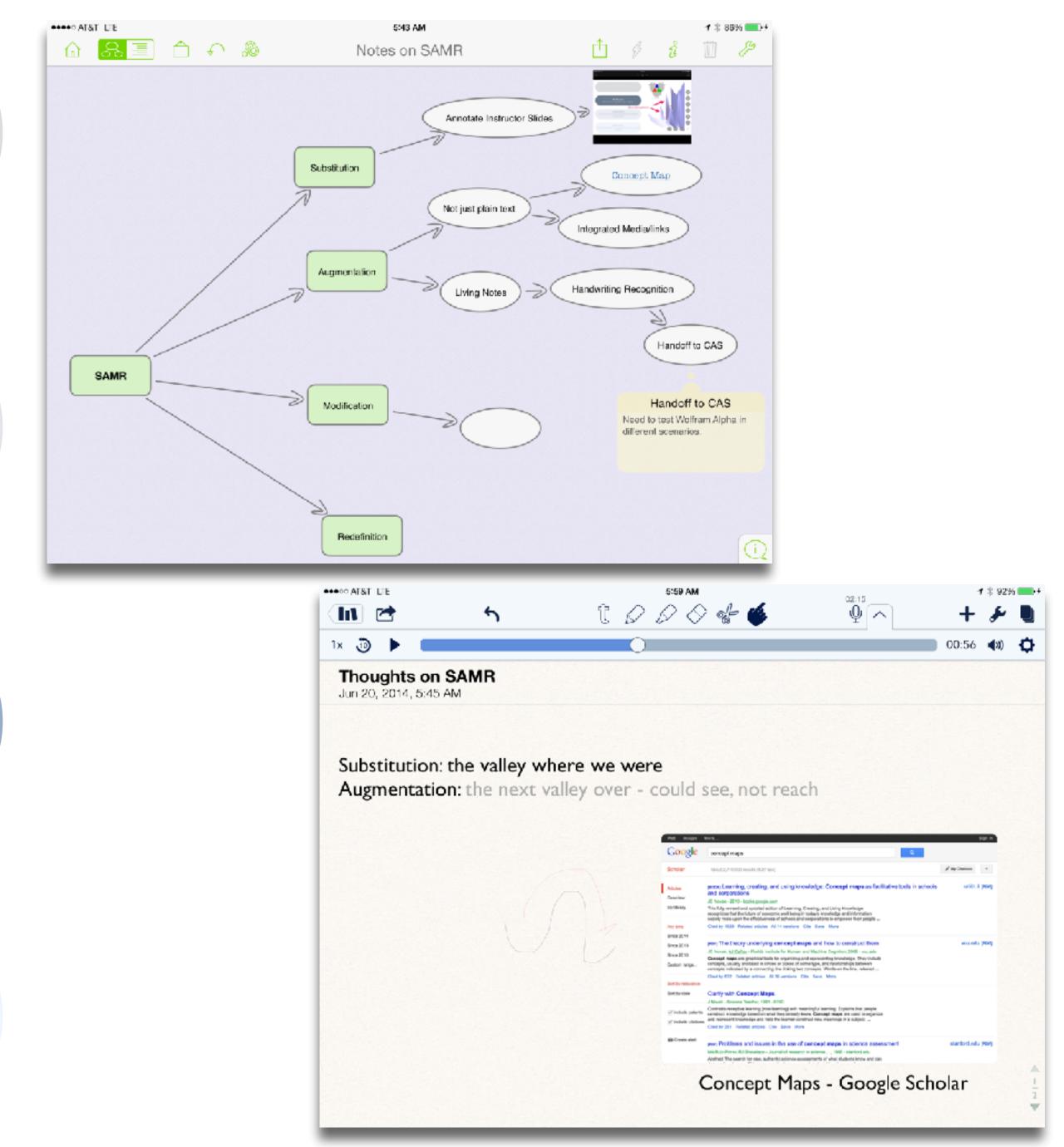
## Modification Tech allows for significant task redesign

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### Substitution Tech acts as a direct tool substitute, with no functional change

John C. Nesbit and Olusola O. Adesope, "Learning With Concept and Knowledge Maps: A Meta-Analysis". Review of Educational Research, Vol. 76, No. 3. (2006)

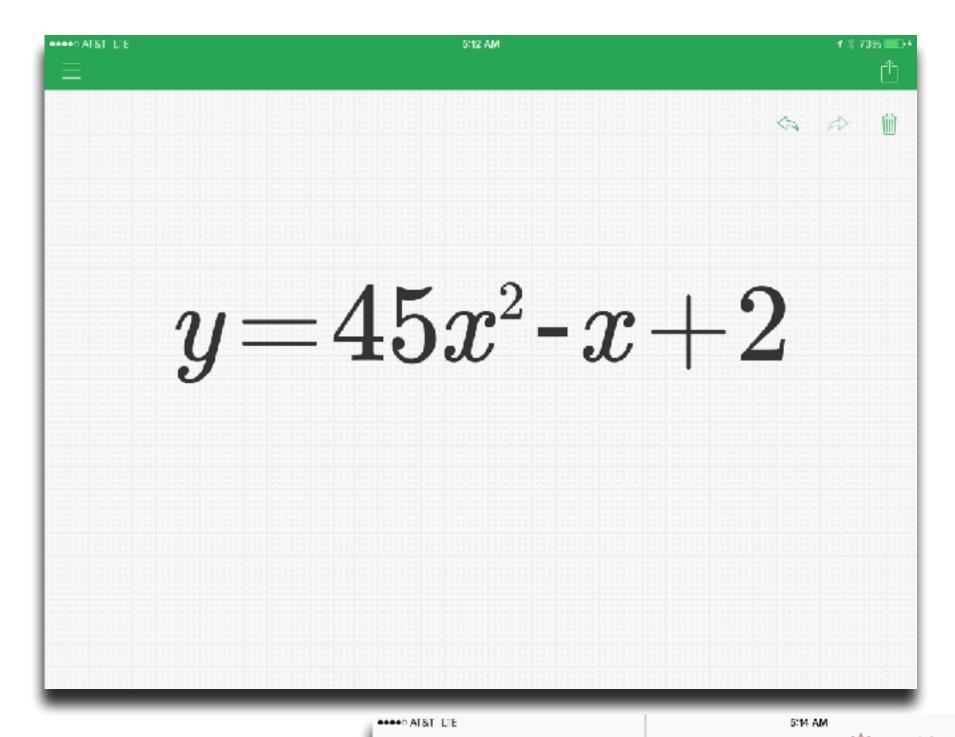


## Modification Tech allows for significant task redesign

### Augmentation

Tech acts as a direct tool substitute, with functional improvement

Substitution Tech acts as a direct tool substitute, with no functional change



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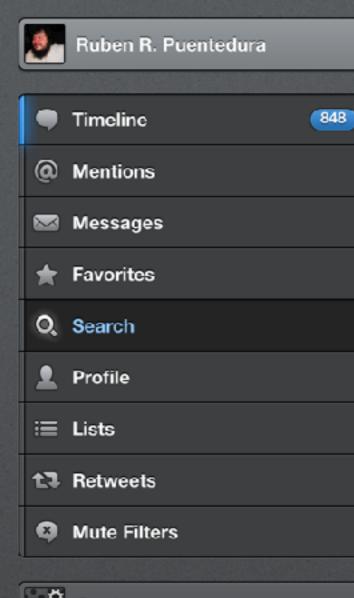
### Modification

Tech allows for significant task redesign

Augmentation Tech acts as a direct tool substitute, with functional improvement

Substitution Tech acts as a direct tool substitute, with no functional change

### AT&T LTE



o<sup>o</sup> Settings

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### #thoughtvectors

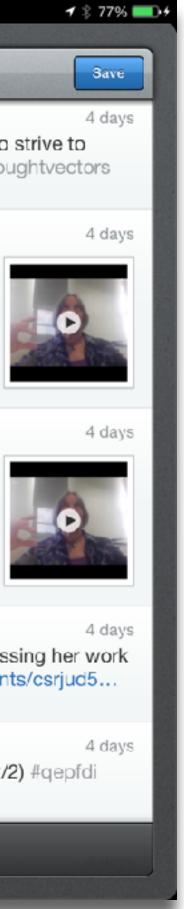


Search

Cindy Jennings @cljennings Sad to me: @ChristinaDEI noting that her father had to strive to share his vision in ways that ppl wanted to hear it. #thoughtvectors

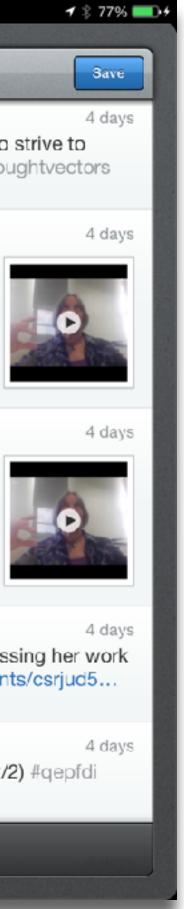


Jon Becker @jonbecker Watch @GardnerCampbell interview @ChristinaDEI, Doug Engelbart's daughter, LIVE youtube.com/watch?v=NBKjl0... #thoughtvectors





Gardner Campbell @GardnerCampbell #thoughtvectors Hangout w Christina Engelbart (@ChristinaDEI): youtube.com/watch?v=NBKjI0.... Join us there or G+ plus.google.com/events/ csrjud5...





Gardner Campbell @GardnerCampbell Hangout w Christina Engelbart (@ChristinaDEI), discussing her work w #thoughtvectors at VCU. 4:30! plus.google.com/events/csrjud5...

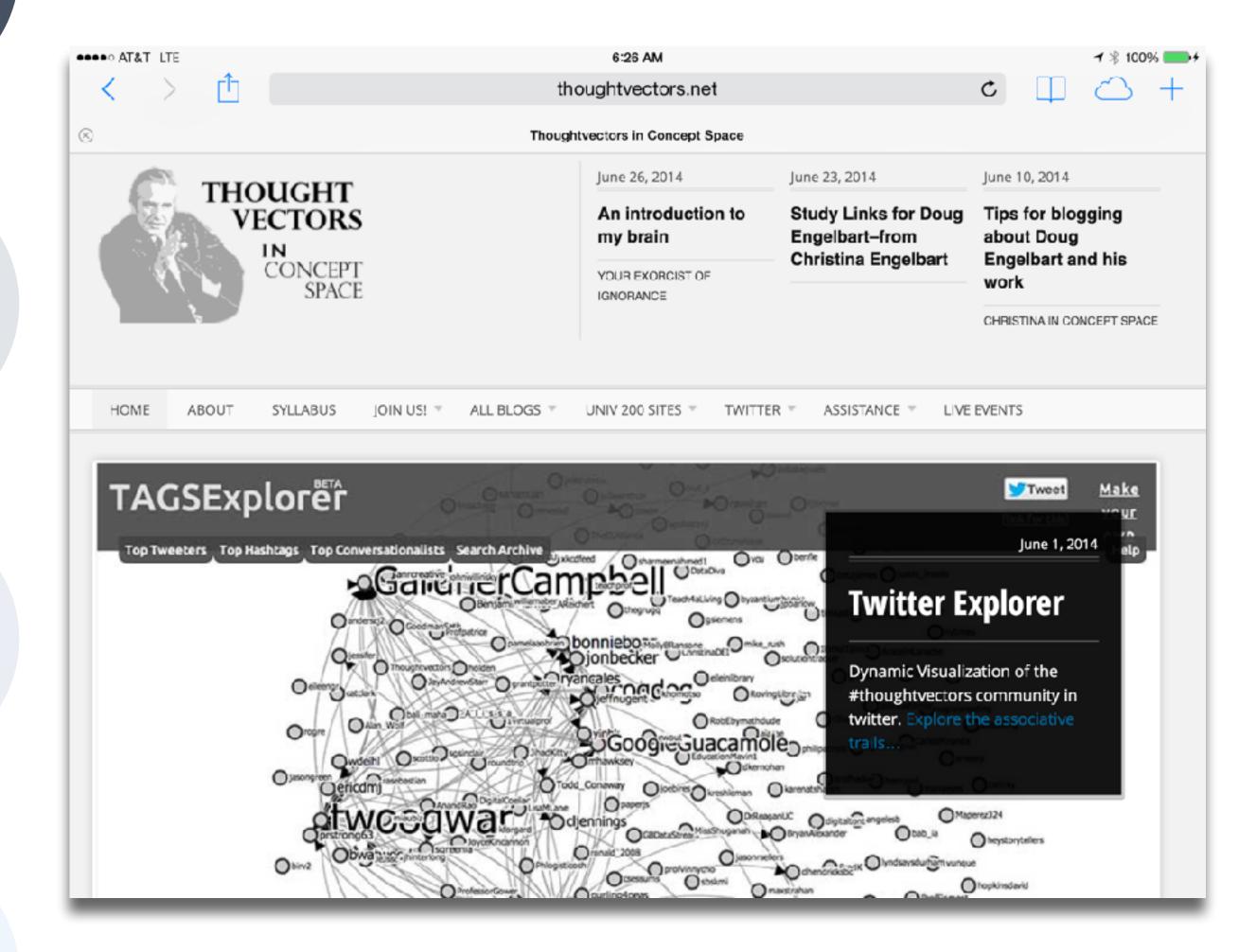


Cindy Jennings @cljennings Early mention of Maria Montessori has my attention! (2/2) #qepfdi #thoughtvectors

100 Tweets

# Modification Tech allows for significant task redesign

## Augmentation Tech acts as a direct tool substitute, with functional improvement



# Choosing the First SAMR Ladder Project: Three Options

### • Your Passion:

- aspect of medicine, what would it be?
- Barriers to Your Students' Progress:
  - beyond?
- What Students Will Do In the Future:
  - future physicians?

• If you had to pick one topic from your class that best exemplifies why you became fascinated with this

• Is there a topic in your class that a significant number of students get stuck on, and fail to progress

• Which topic from your class would, if deeply understood, best serve the interests of your students as

In this exercise you will design a SAMR ladder to transform a unit of instruction; the complete exercise should take about 1 hour.

- Please break up into teams of 3-5 participants.
- according to one of these criteria:
  - Your Passion: what would it be?
  - Barriers to Your Students' Progress: • Is there a topic in your class that a significant number of students get stuck on, and fail to progress beyond?
  - What Students Will Do In the Future: •
- narrow.
- minimum of additional work needed.

Your team should take 10 minutes to select the topic that you will use as the basis for your ladder. You should select the topic

If you had to pick one topic from your class that best exemplifies why you became fascinated with this aspect of medicine,

Which topic from your class would, if deeply understood, best serve the interests of your students as future physicians?

You should make sure that the topic is not too broad or too narrow - for instance, trying to transform the entire Physiology curriculum would be too ambitious for this exercise, but focusing solely on teaching the structure of myosin would be too

Having chosen a topic, you should design a SAMR ladder to transform how it is taught today. Plan to spend about 20 minutes identifying key pedagogical goals and creating a "rough" version of the ladder, followed by 20 minutes refining and revising the ladder to put it into final form, including the tools you plan to use and reasonably detailed descriptions of the activities planned.

In the final 10 minutes of this exercise, transcribe a description of your ladder, making sure that the writeup is understandable by someone who has not participated in your discussions, and is detailed enough that they could implement your ladder with a

# Determining SAMR Level: Questions and Transitions

### • Substitution:

- What is gained by replacing the older technology with the new technology?
- Substitution to Augmentation:
  - technology at a fundamental level?
  - How does this feature contribute to the design?
- Augmentation to Modification:
  - How is the original task being modified?
  - Does this modification fundamentally depend upon the new technology?
  - How does this modification contribute to the design?
- Modification to Redefinition:
  - What is the new task?
  - Is any portion of the original task retained?
  - How is the new task uniquely made possible by the new technology?
  - How does it contribute to the design?

Has an improvement been added to the task process that could not be accomplished with the older

# S to A: The Value of Shared Practices

- Augmented Note Taking and Annotation
- Visualization Methods:
  - 5 Primary Domains: Space, Time, Networks, Text, Number
- Simple Blogging
- Simple Digital Storytelling Video •
- Flipped Classroom: •
  - Materials Creation
  - Peer Discussion/Instruction Methods
- Simple Interactive Fiction
- LMS Practices

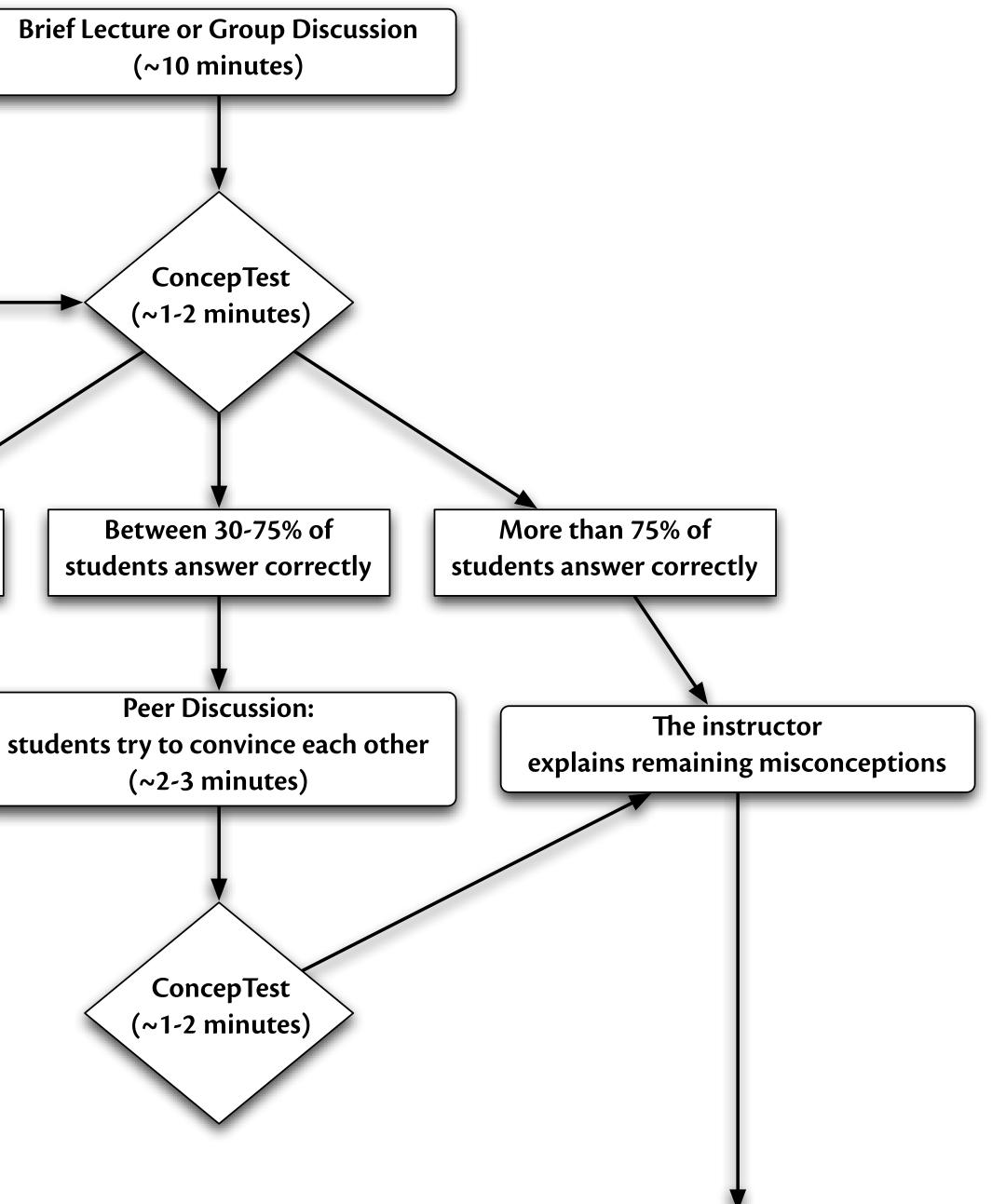
## Black and Wiliam: Defining Formative Assessment

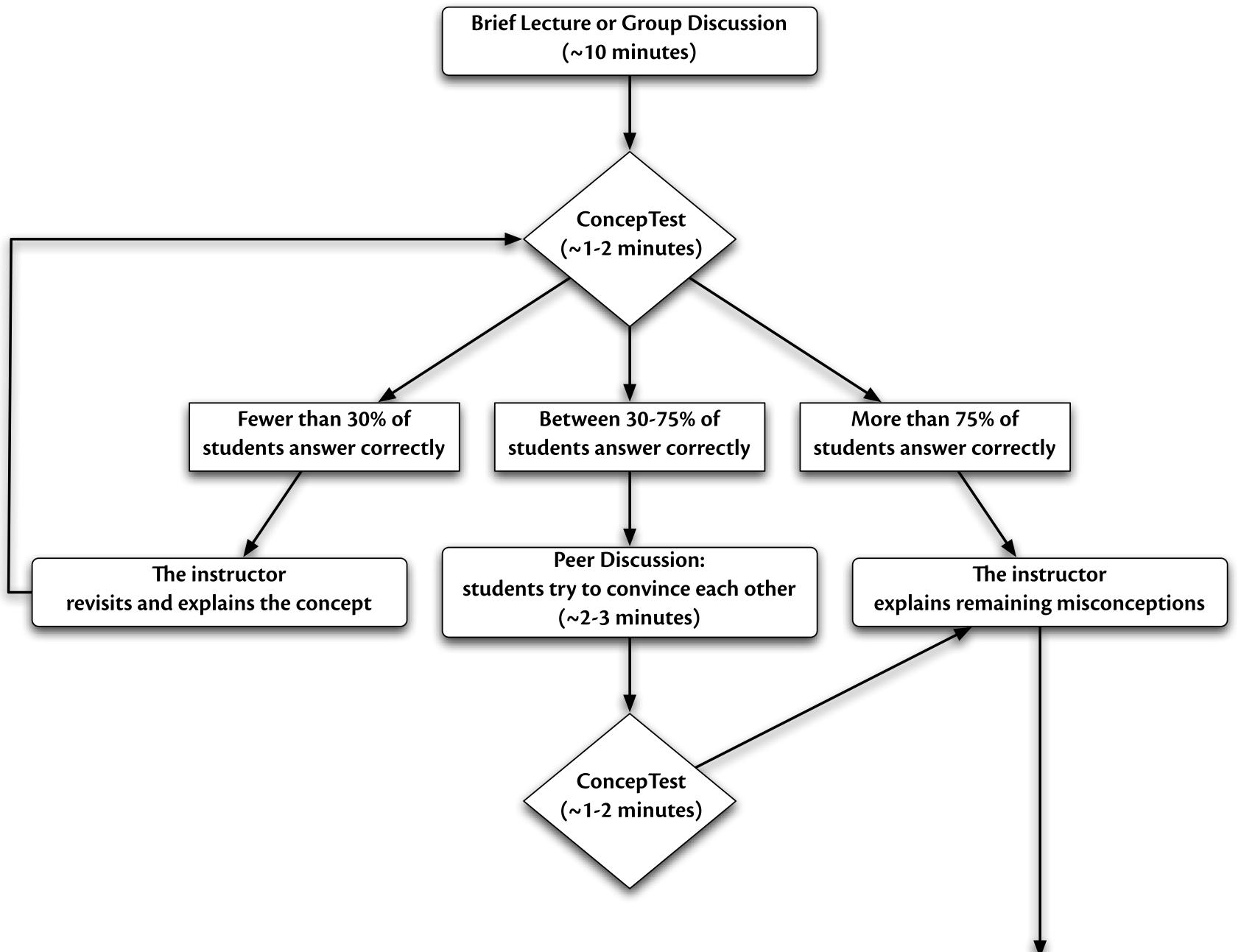
"Practice in a classroom is formative to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited."

# Wiliam: A Framework for Formative Assessment

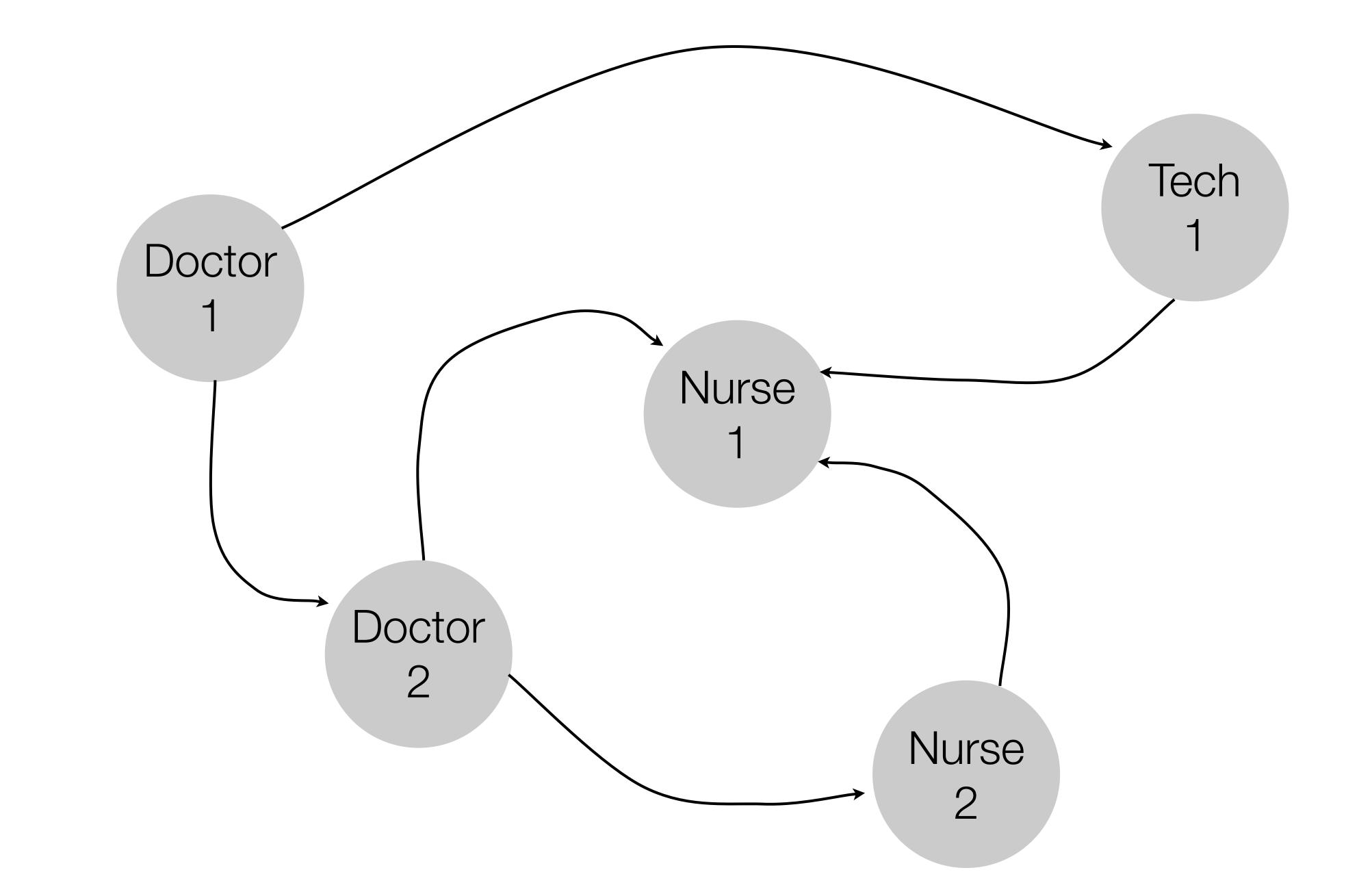
	Where the learner is going	Where the learner is right now	How to get there
Teacher	1 Clarifying learning intentions and criteria for success	2 Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding	3 Providing feedback that moves learners forward
Peer	Understanding and sharing learning intentions and criteria for success	4 Activating students as instructional resources for one another	
Learner	Understanding learning intentions and criteria for success	5 Activating students as the owners of their own learning	

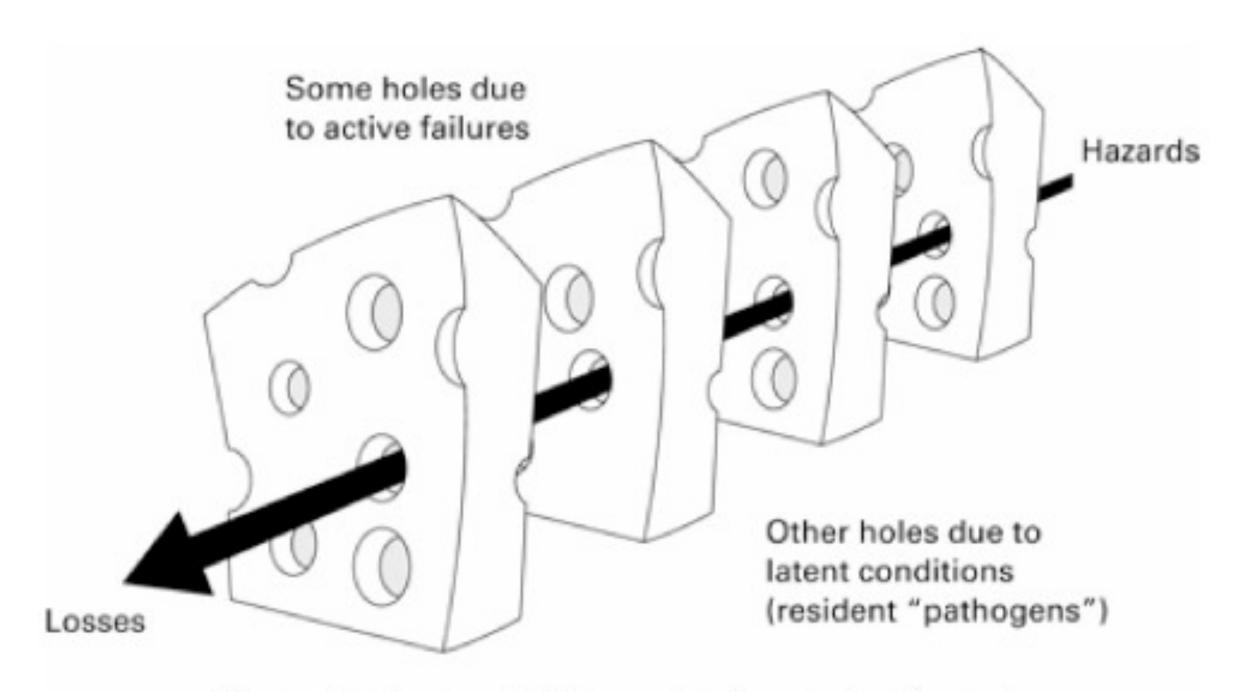
Dylan Wiliam, Embedded Formative Assessment. Solution Tree (2011)











Successive layers of defences, barriers and safeguards

Reason, James. Human Error. Cambridge University Press (1990)



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### Anticoagulants and Communication

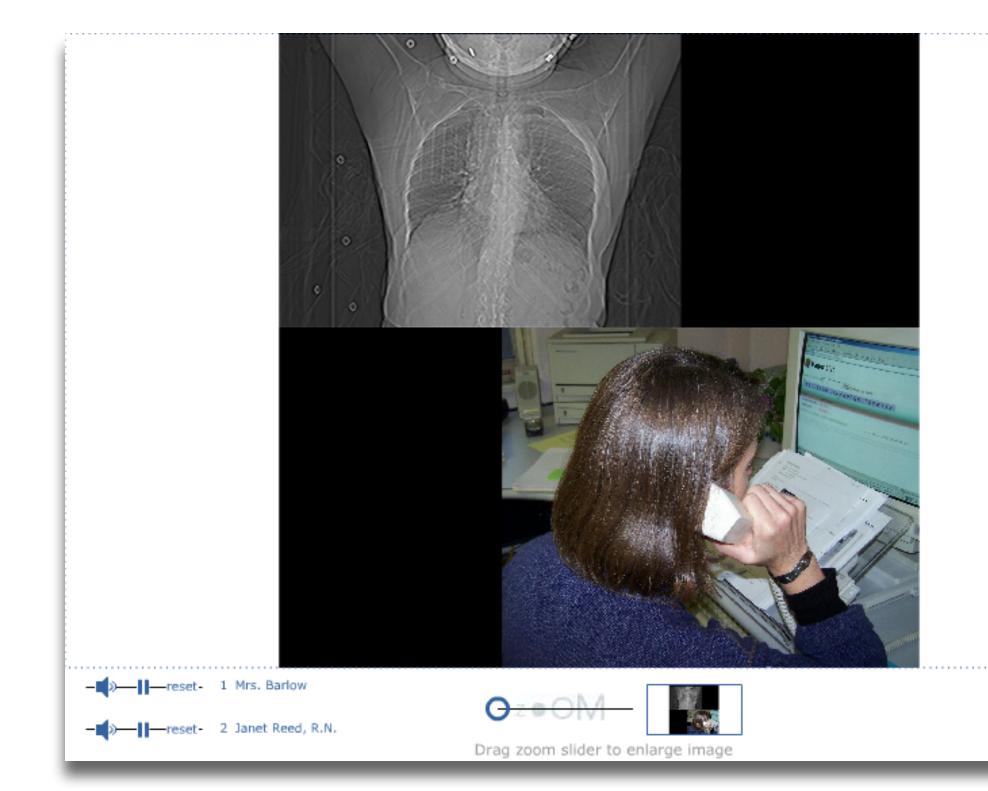


Why is this so complicated? I just want a piece of tissue!

I forget how many people "touch " the patient... to get this stuff done.

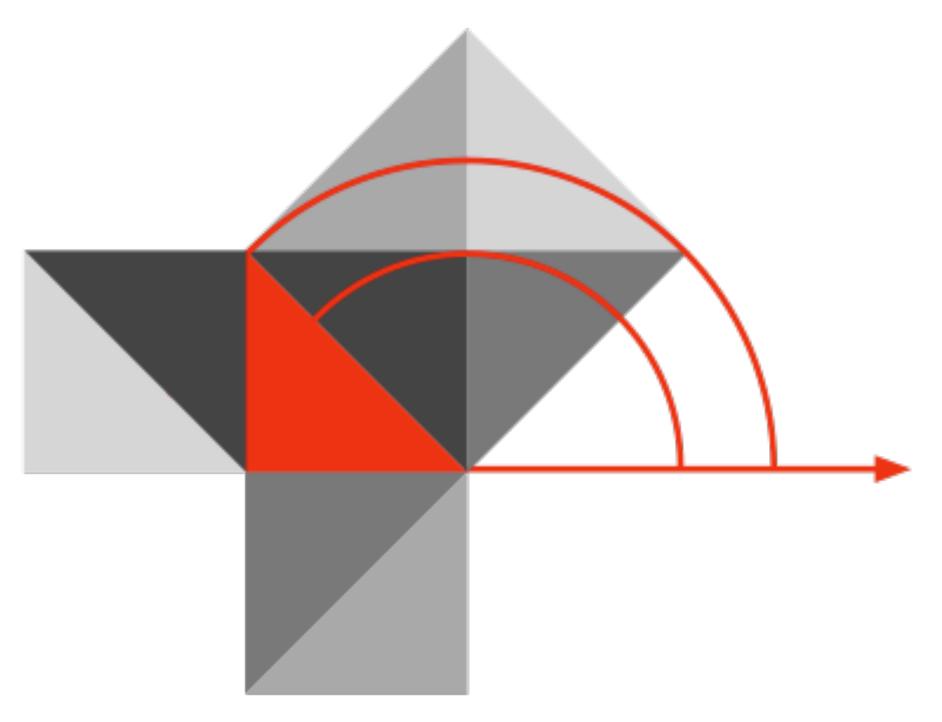
Frank Monroe, M.D.

Expectation Disappointment Understanding Communication Appreciation





## Hippasus



## Blog: http://hippasus.com/blog/ Email: rubenrp@hippasus.com Twitter: @rubenrp

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