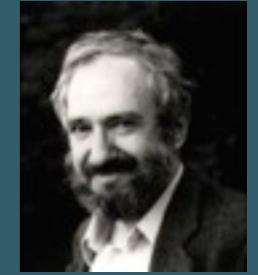


The SAMR Model: Background and Exemplars

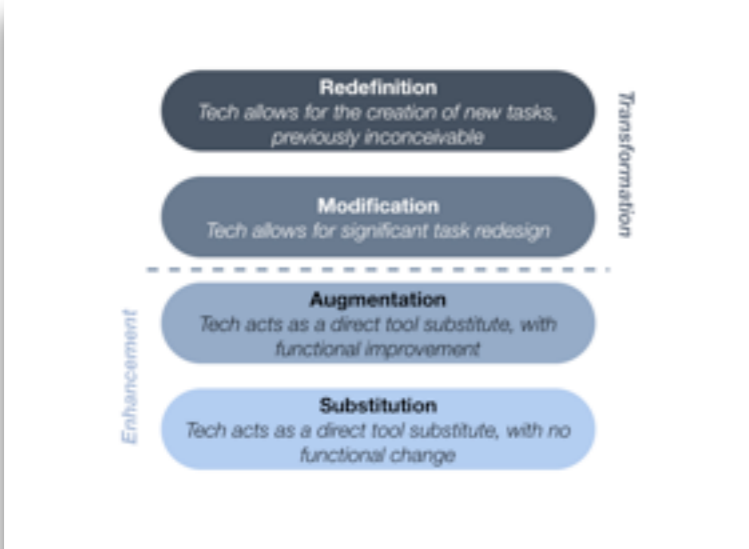
Ruben R. Puentedura, Ph.D.



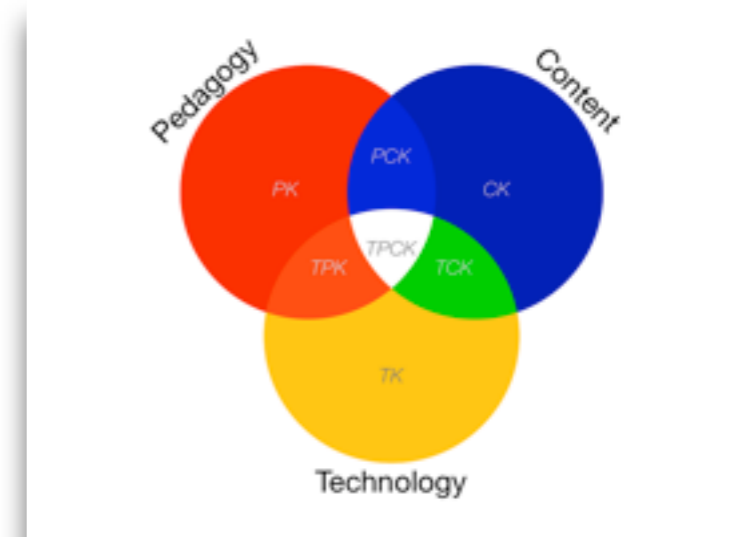
Augmenting Human Intellect & Learning Capacity



21st Century Learning



Social	Mobility	Visualization	Storytelling	Gaming
200,000 years	70,000 years	40,000 years	17,000 years	8,000 years



One-to-One Technologies



Ubiquity



Intimacy



Embeddedness

Transformation

Redefinition

Tech allows for the creation of new tasks, previously inconceivable

Modification

Tech allows for significant task redesign

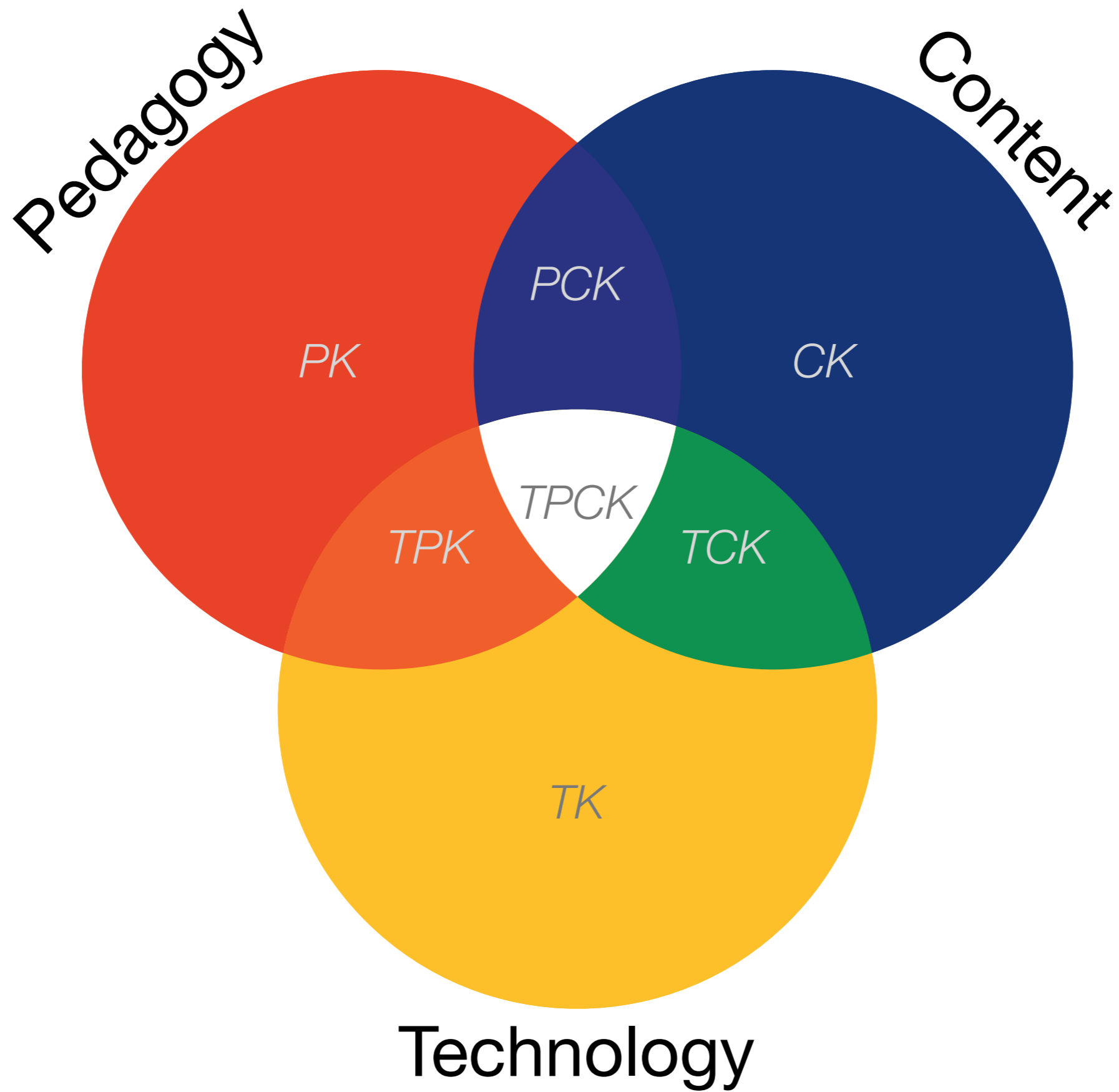
Enhancement

Augmentation

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Social

Mobility

Visualization

Storytelling

Gaming

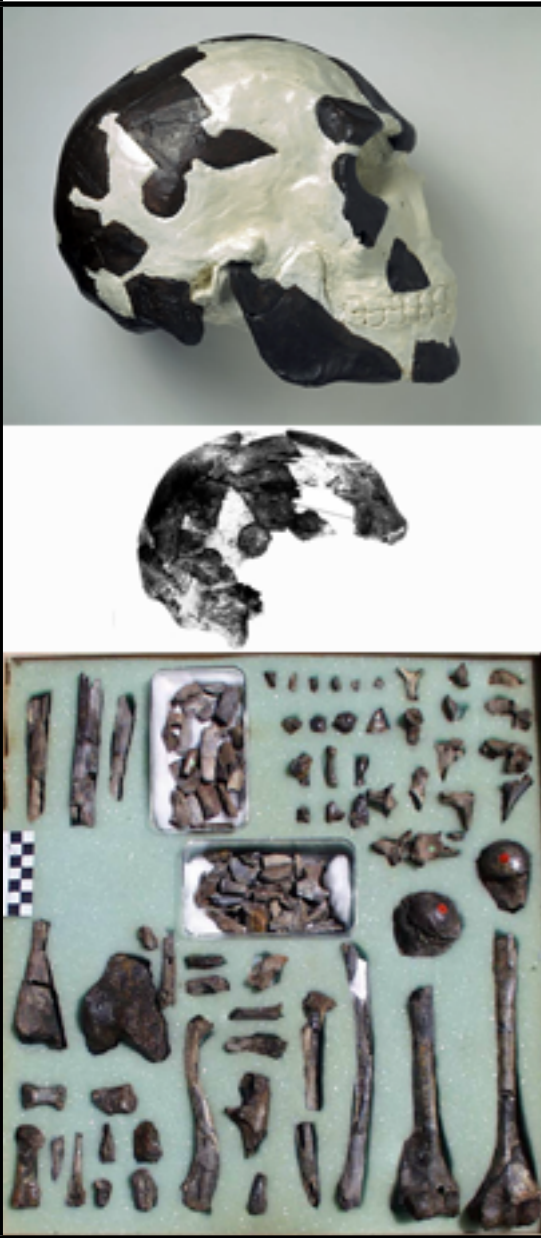
200,000
years

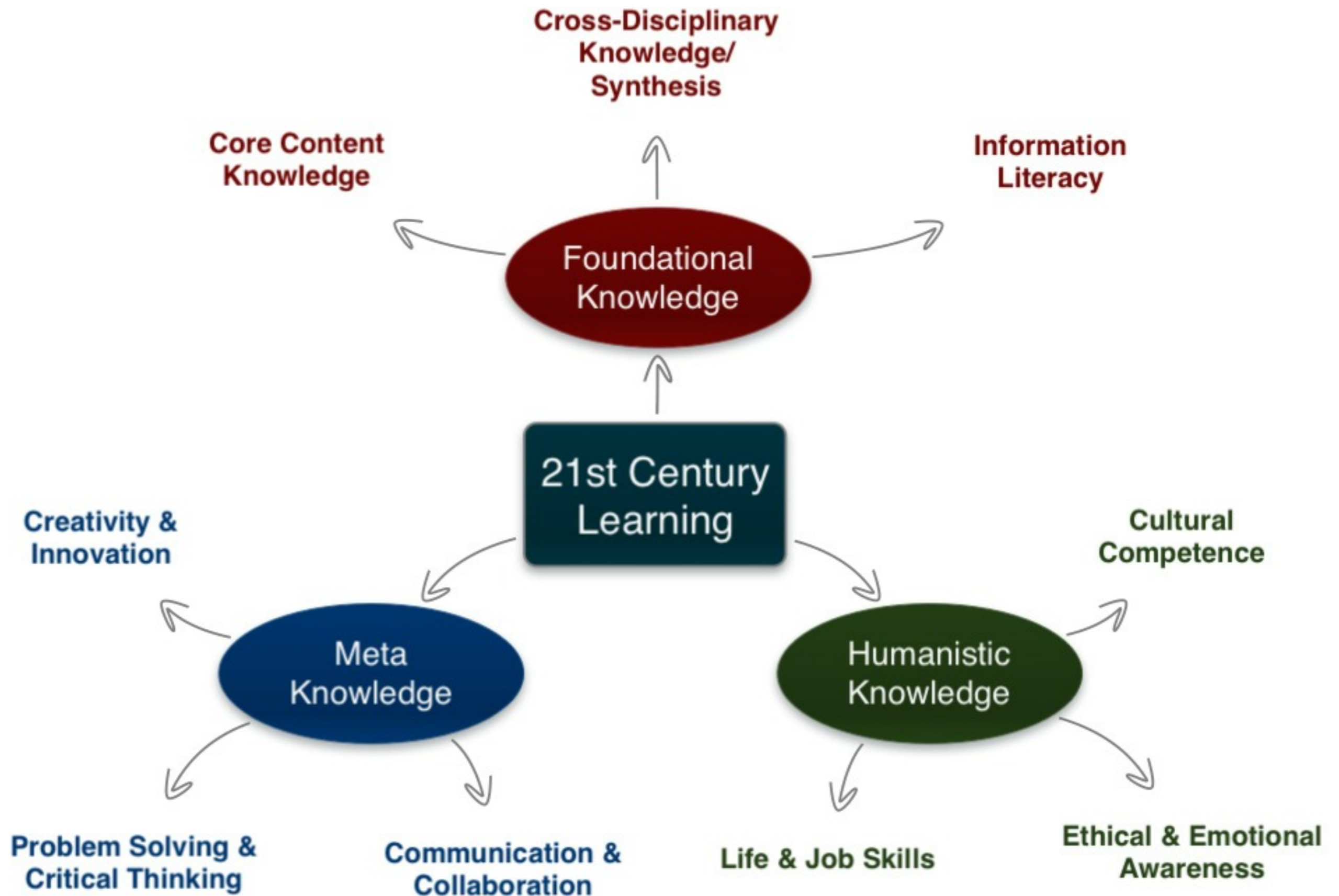
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years

40,000
years

17,000
years

8,000
years







P21 Common Core Toolkit

A Guide to Aligning the Common Core State Standards
with the Framework for 21st Century Skills



PARTNERSHIP FOR
21ST CENTURY SKILLS

It is imperative that the **CCSS** be considered the “**floor**”—not the “**ceiling**”—when it comes to expectations for student performance in the 21st century.

History

Lesh: Teaching History – Concepts and Criteria

- **Core Concepts:**

- Causality
- Chronology
- Multiple Perspectives
- Contingency
- Empathy
- Change and Continuity Over Time
- Influence/Significance/Impact
- Contrasting Interpretations
- Intent/Motivation

- **Guiding Criteria:**

- Does the question represent an important issue to historical and contemporary times?
- Is the question debatable?
- Does the question represent a reasonable amount of content?
- Will the question hold the interest of middle or high school students?
- Is the question appropriate given the materials available?
- Is the question challenging for the students you are teaching?
- What organizing historical concepts will be emphasized?

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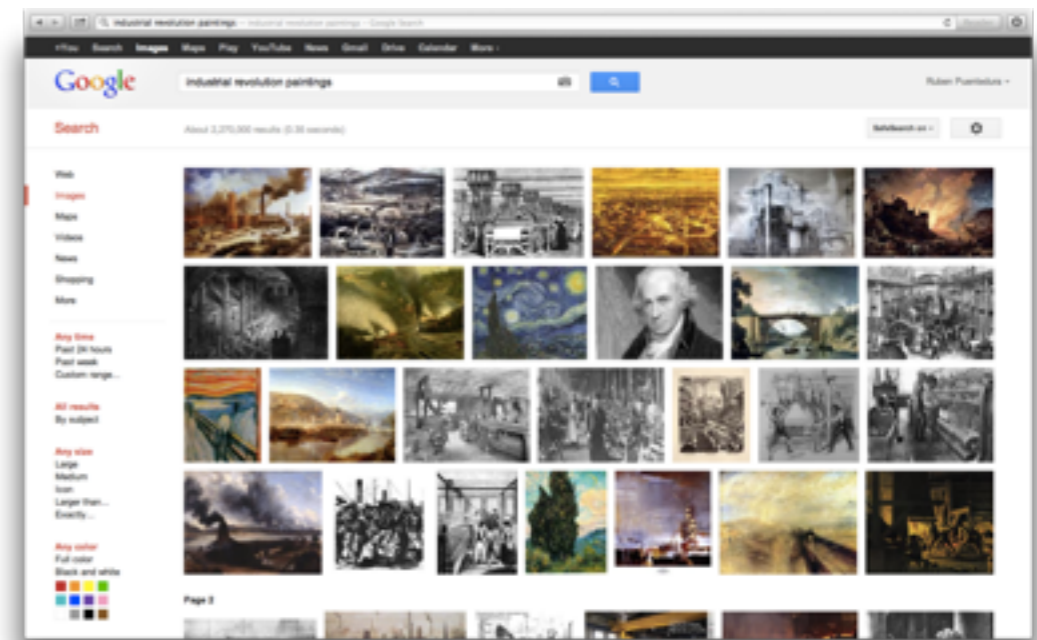
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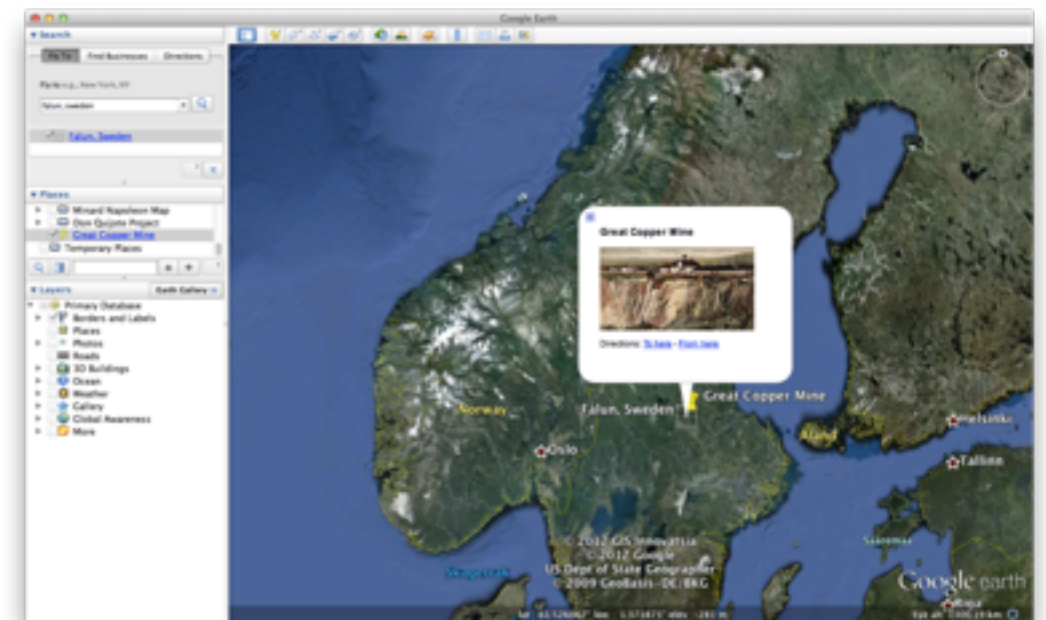
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English

Marzano: Six Steps to Effective Vocabulary Instruction

- Step 1: The Teacher Provides a Description, Explanation, or Example of the New Term
- Step 2: Students Restate the Explanation of the New Term in Their Own Words
- Step 3: Students Create a Nonlinguistic Representation of the Term
- Step 4: Students Periodically Do Activities That Help Them Add to Their Knowledge of Vocabulary Terms
- Step 5: Periodically Students Are Asked to Discuss the Terms with One Another
- Step 6: Periodically Students Are Involved in Games That Allow Them to Play with the Terms

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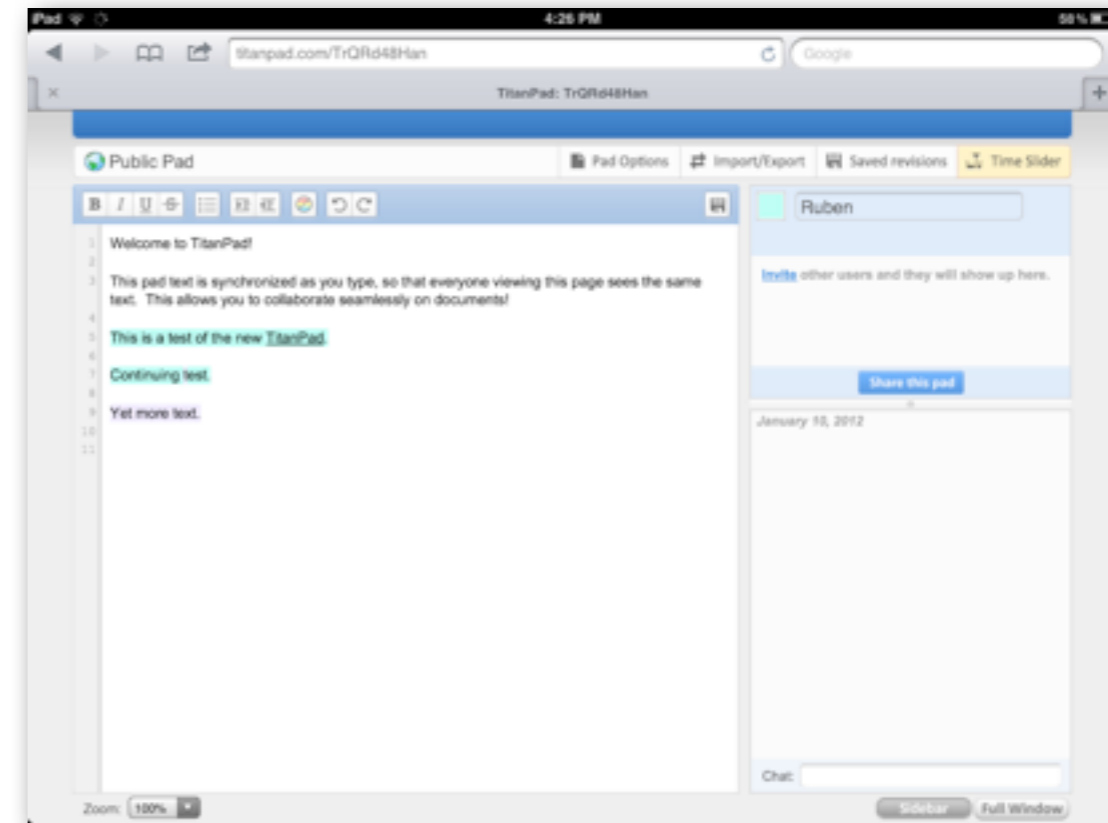
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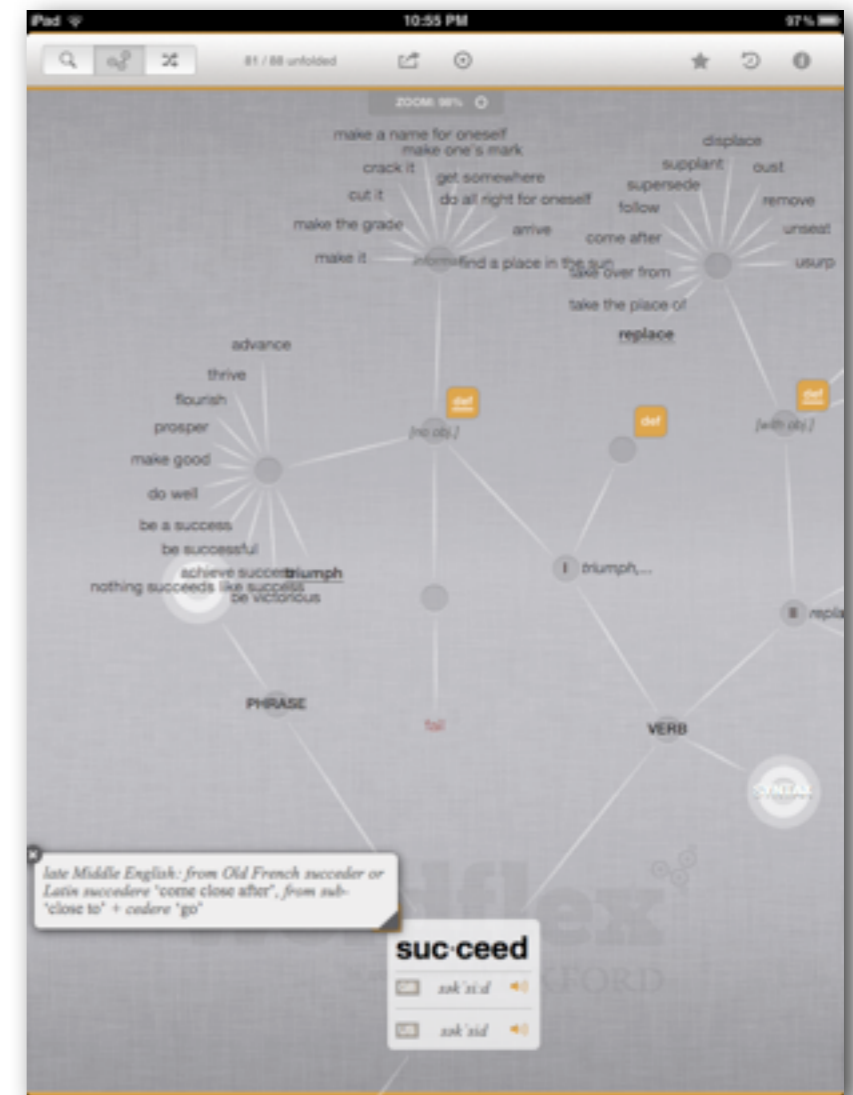
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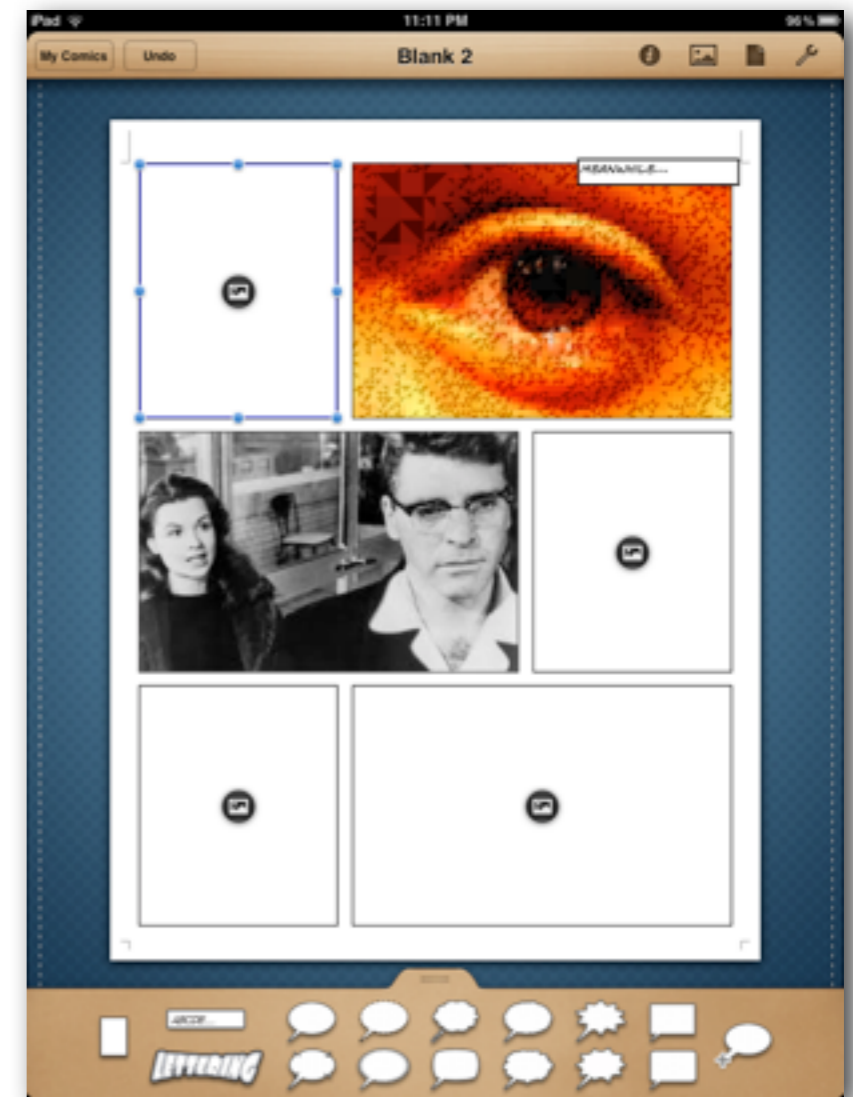
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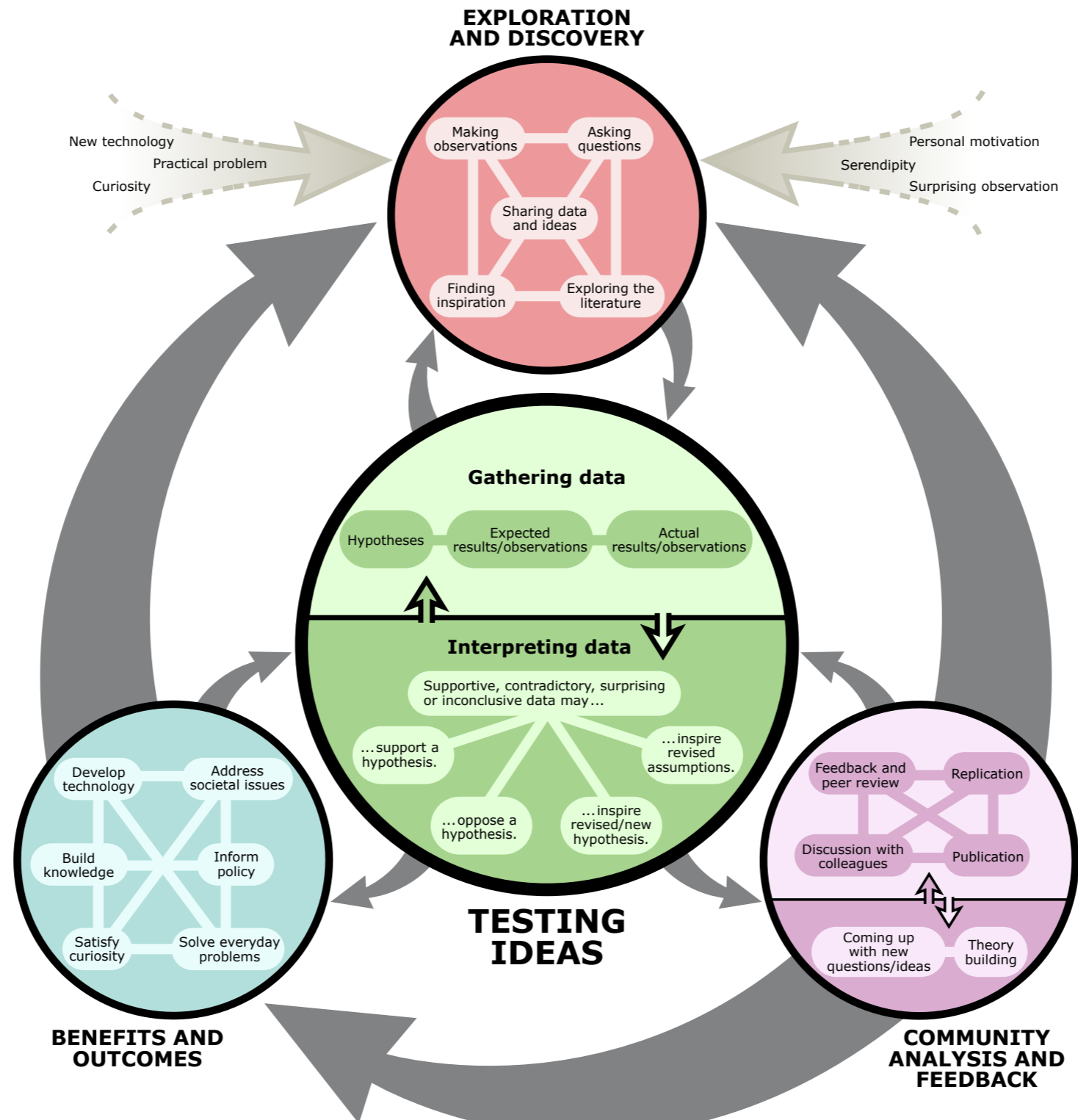
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Biology

Understanding Science: How Science Works



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The screenshot shows a mobile interface for a Wikipedia article titled "Aquatic Biomes". A definition pop-up for "biome" is overlaid on the left, showing the pronunciation [ˈbi.ɒm] and the definition: "a large naturally occurring community of flora and fauna occupying a major habitat, e.g., forest or tundra." Below the pop-up are "Search Web" and "Search Wikipedia" buttons. The main article text discusses aquatic biomes covering 75% of Earth's surface and lists four types: surface waters, deep waters, shores, and bottoms. A yellow highlight is present on the text: "Aquatic environments have less variation globally than those on land." Below the text is a 3D star-shaped model of a sea star. To the right is an interactive map titled "Worldwide Photosynthetic Activity" showing global photosynthesis levels by season (June, Dec, June, Dec). A caption below the map reads: "Interactive The latitudes of peak photosynthesis change with the seasons." The page number "31" is visible at the bottom right.

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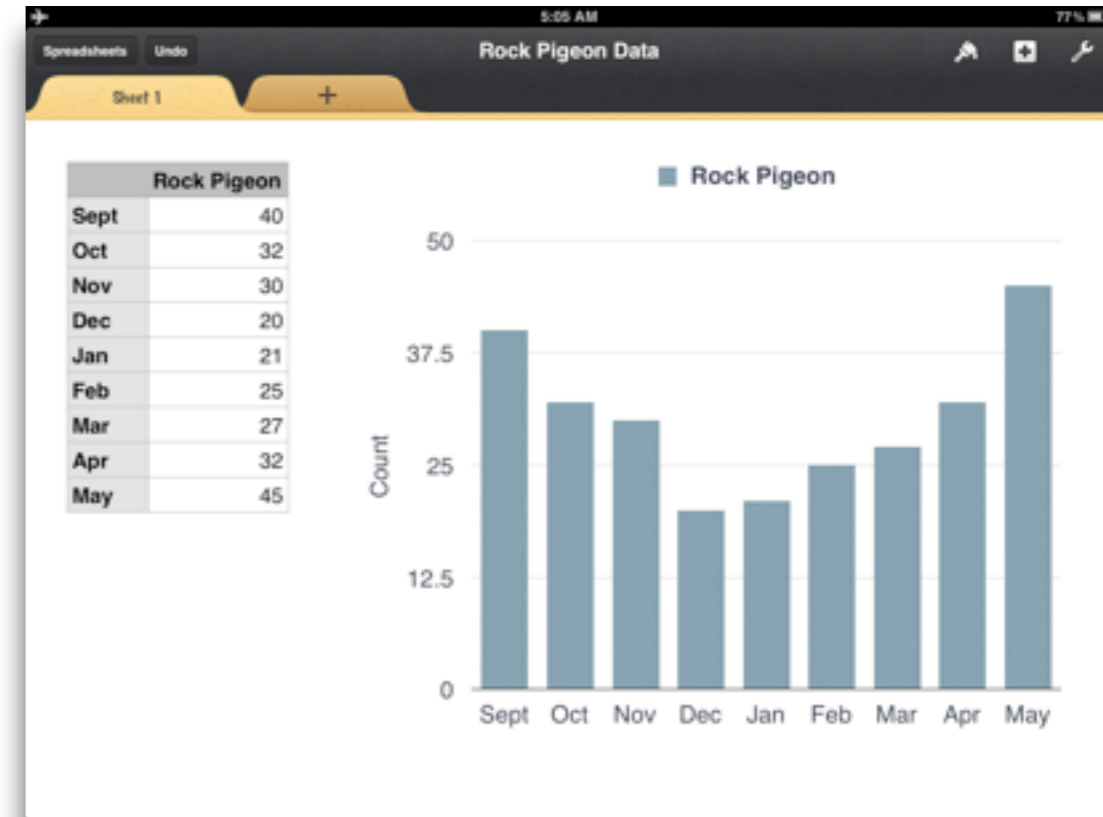
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Physics

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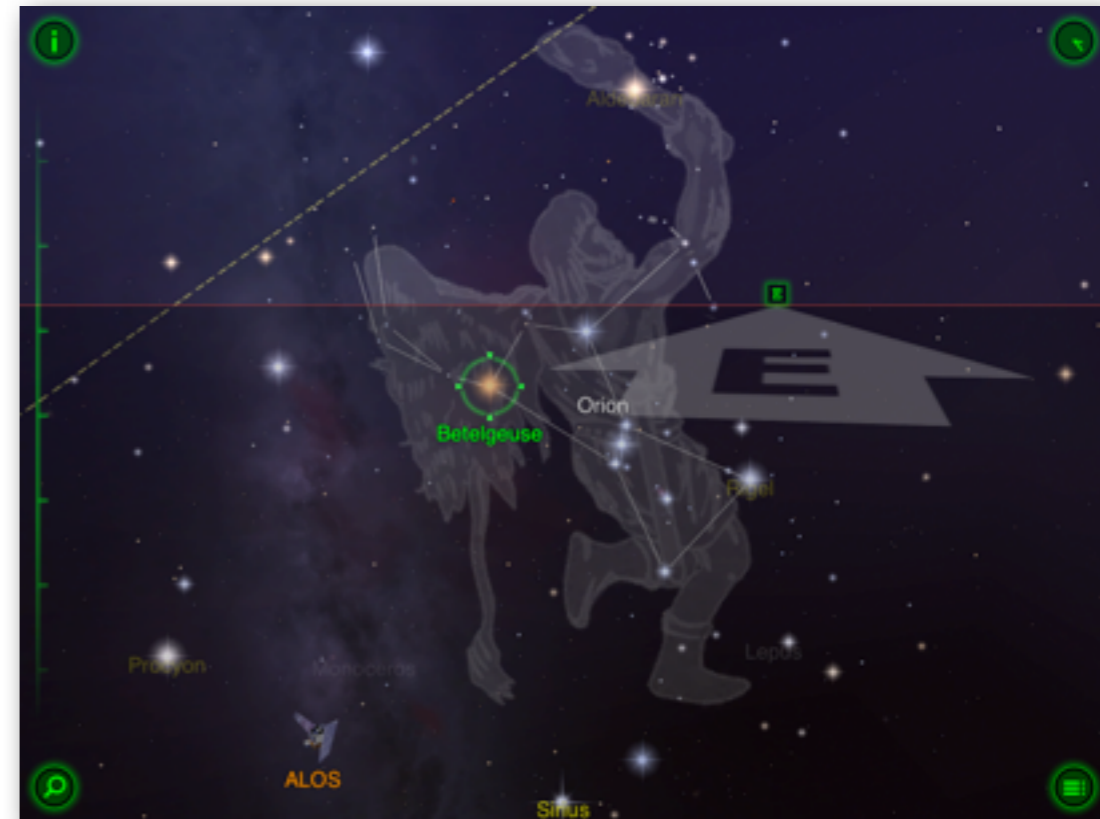
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The screenshot shows a mobile application interface for a physics course assistant. The title bar at the top reads "Wolfram PHYSICS I COURSE ASSISTANT". The main content area is titled "Gravitational Force" and includes a "Back" button. Below the title, there is a brief instruction: "Use Newton's law of universal gravitation to calculate the gravitational force between two point masses." The interface features three input fields: "Mass 1:" with a value of "5.9721986x10..." and a unit dropdown set to "kg"; "Mass 2:" with a value of "60" and a unit dropdown set to "g"; and "Distance:" with a value of "6367.5" and a unit dropdown set to "km". A "Compute" button is located at the bottom of the input section. To the right, a "Result" panel displays the calculated gravitational force in three units: "589.8 mN (millinewtons)", "0.1326 lbf (pounds-force)", and "0.5898 N (newtons)". Below the result, an "Equation" panel shows the formula $F = \frac{G m_1 m_2}{r^2}$ and a table defining the variables: F is gravitational force, m_1 is primary mass, m_2 is secondary mass, r is distance, and G is the Newtonian gravitational constant ($6.67 \times 10^{-11} \text{ m}^3/\text{kg s}^2$). The bottom of the screen shows "Powered by WolframAlpha" and a copyright notice for 2012.

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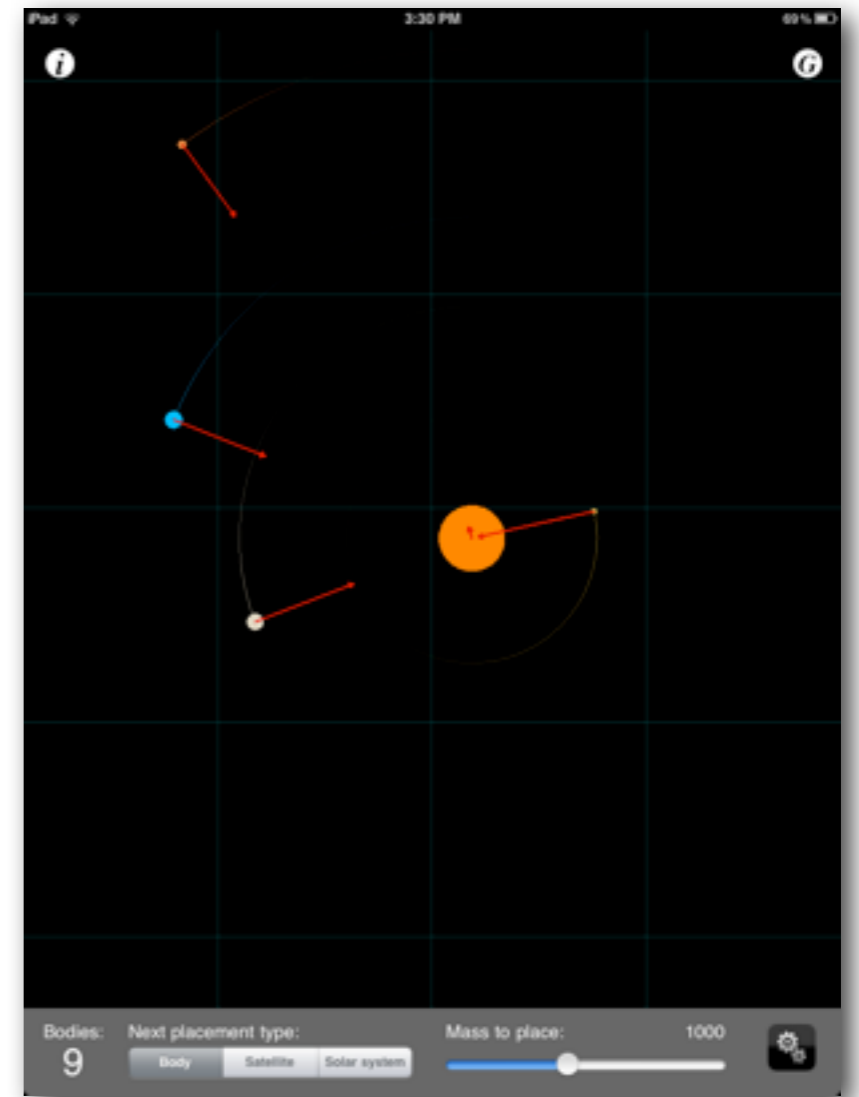
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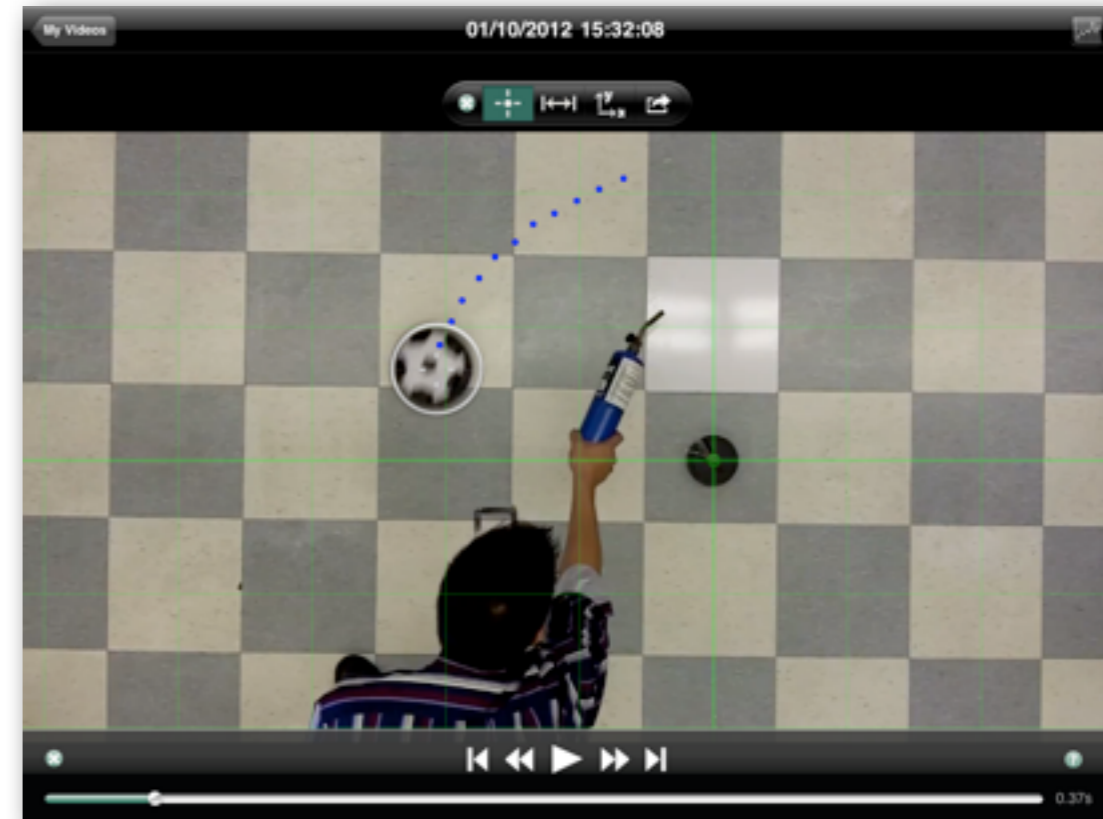
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Literature

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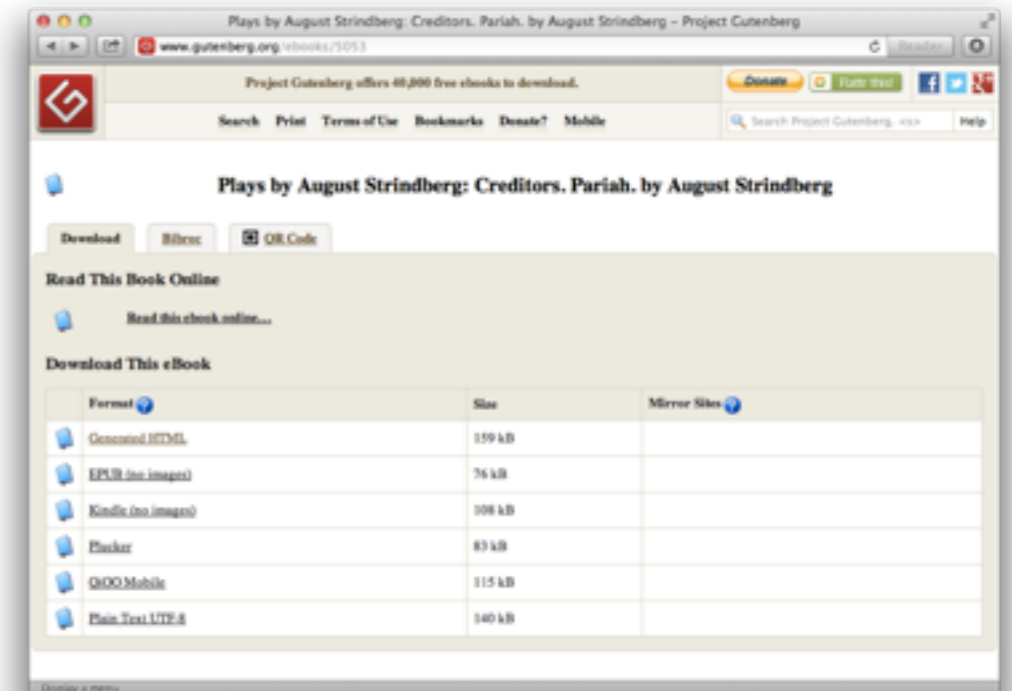
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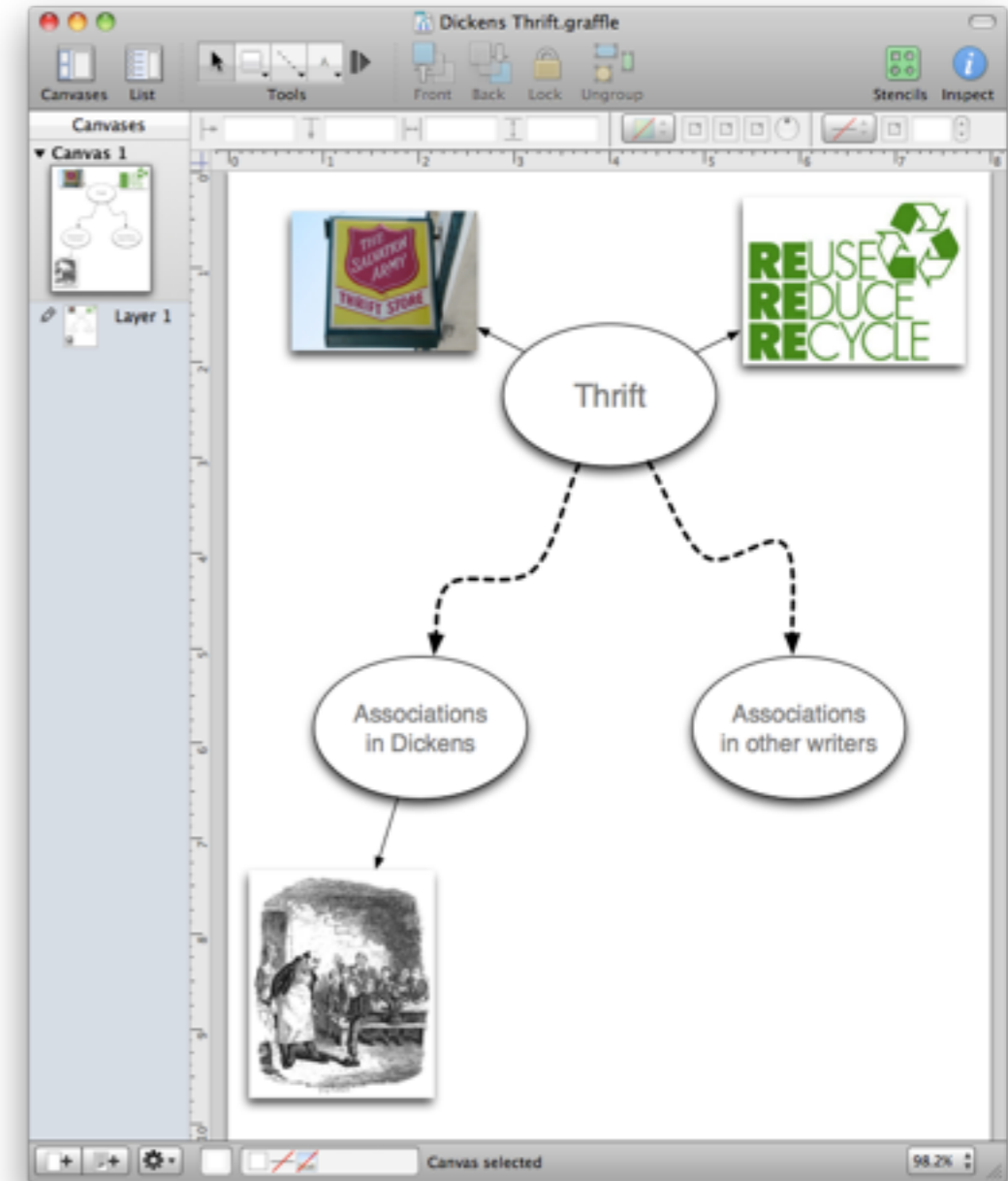
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Geography

Gersmehl:

Teaching Geography – Four Cornerstones

- Location
 - Position in space
- Condition
 - Mix of natural & artificial features that give meaning to a location
- Links
 - Connections between places
- Region
 - Formal region: group of places with similar conditions
 - Functional region: group of places linked together by a flow

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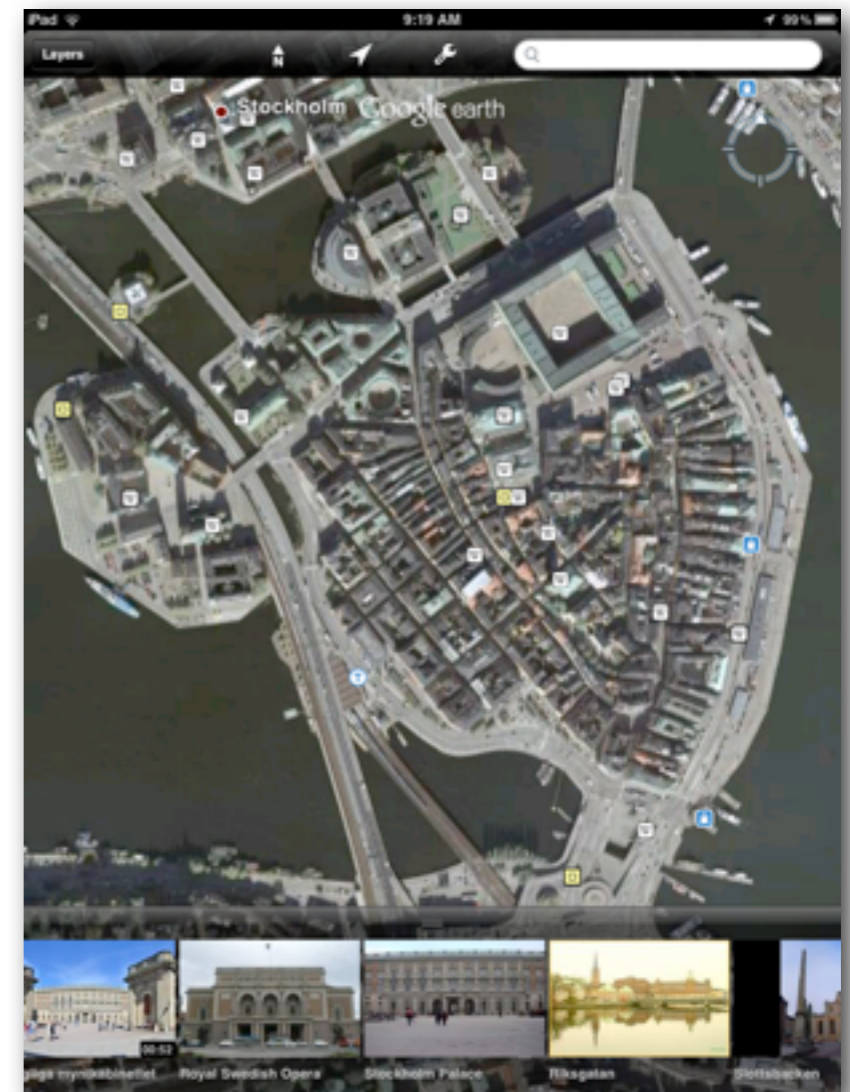
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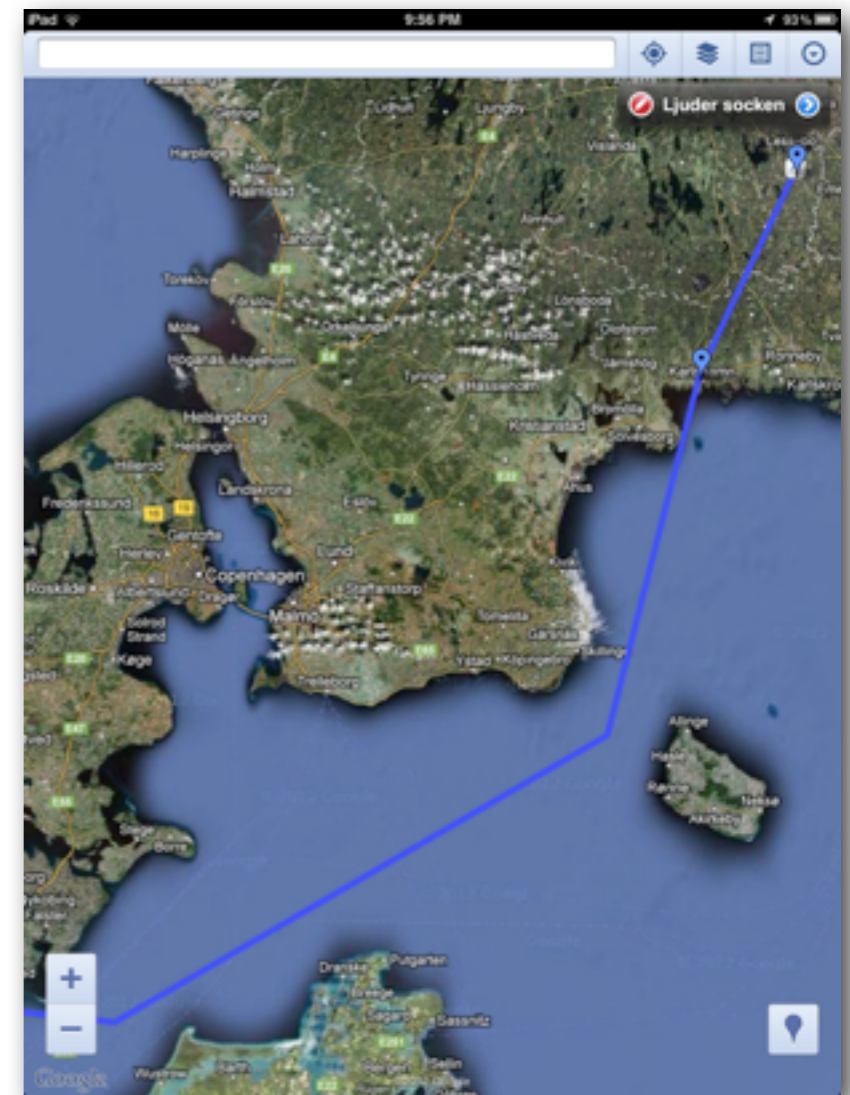
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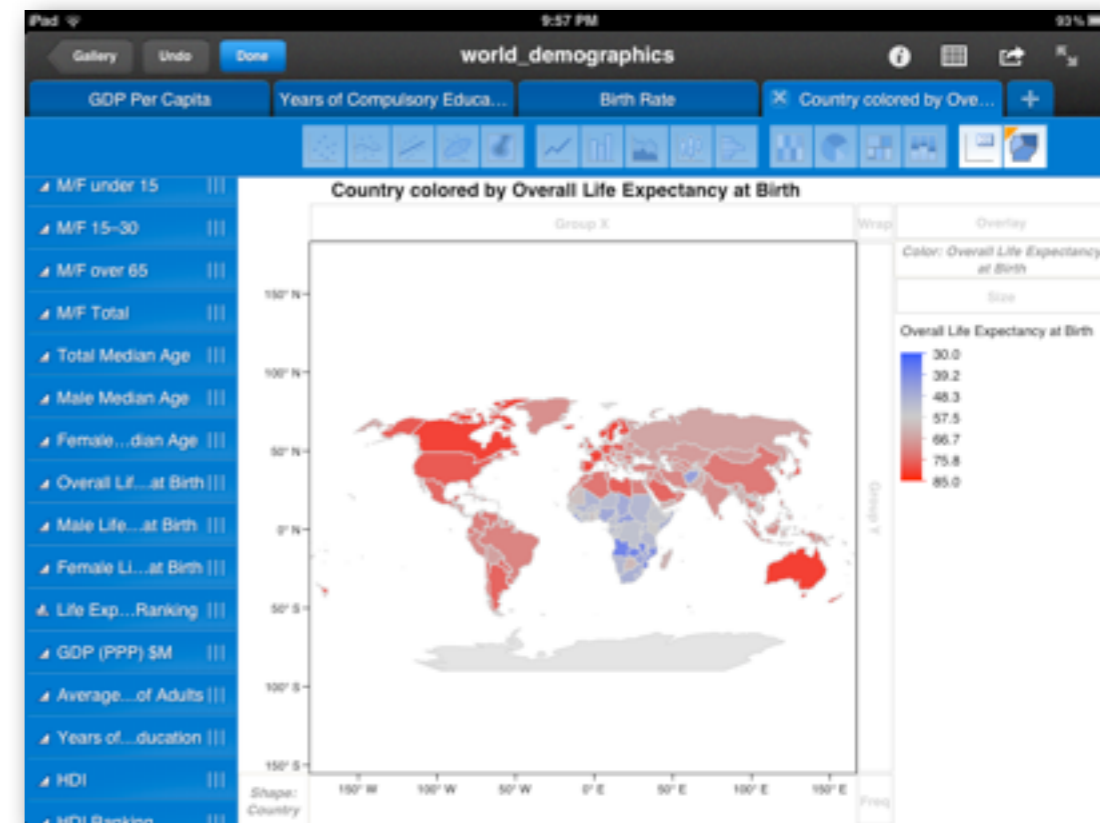
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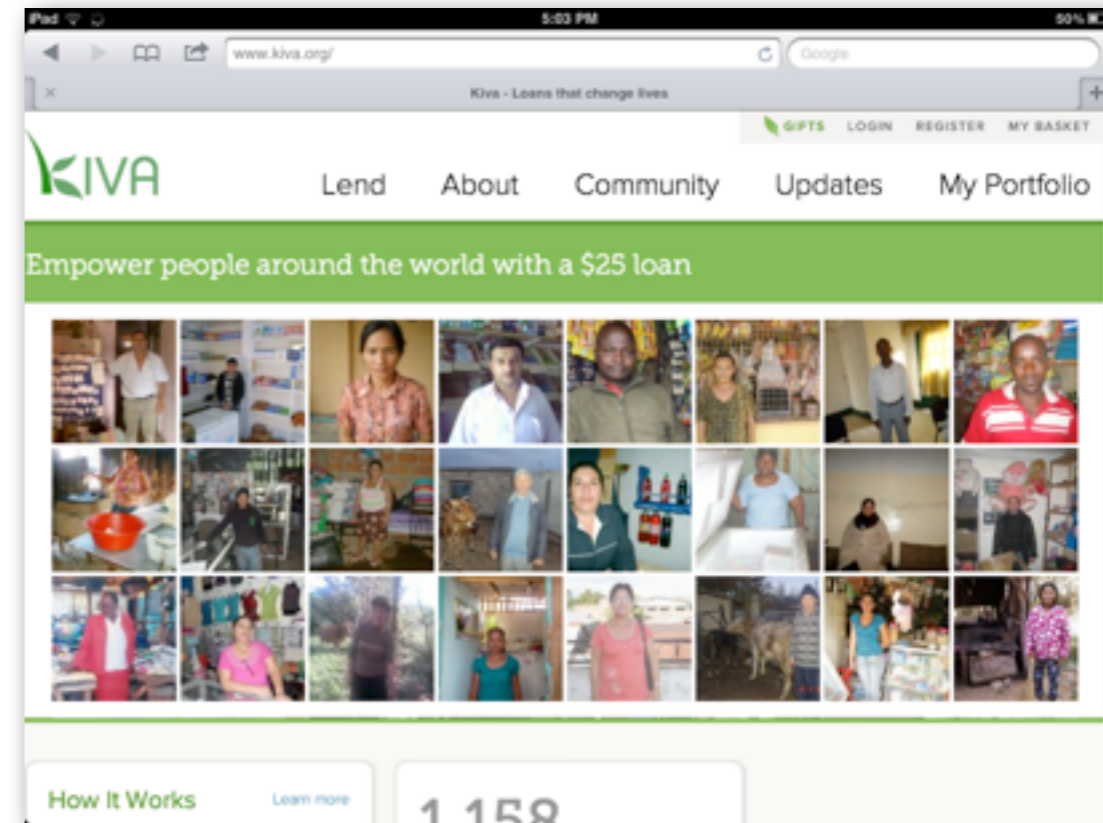
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Mathematics I

Redefinition

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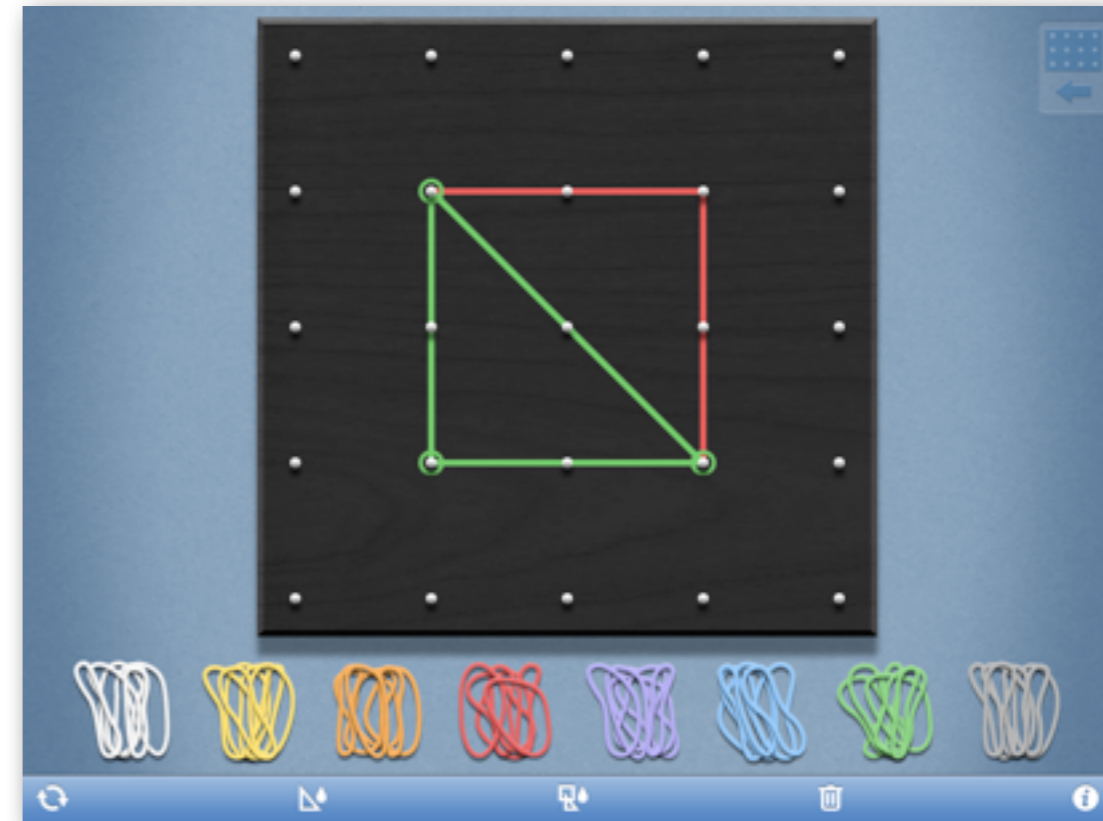
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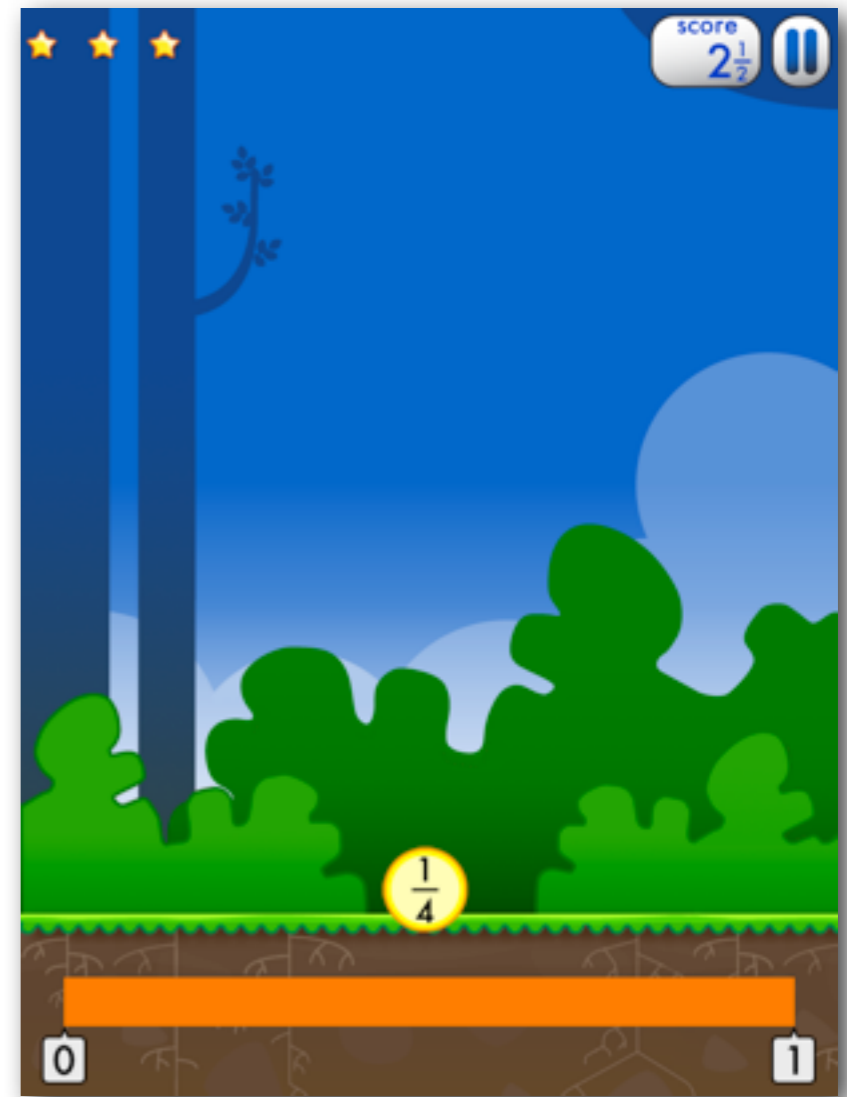
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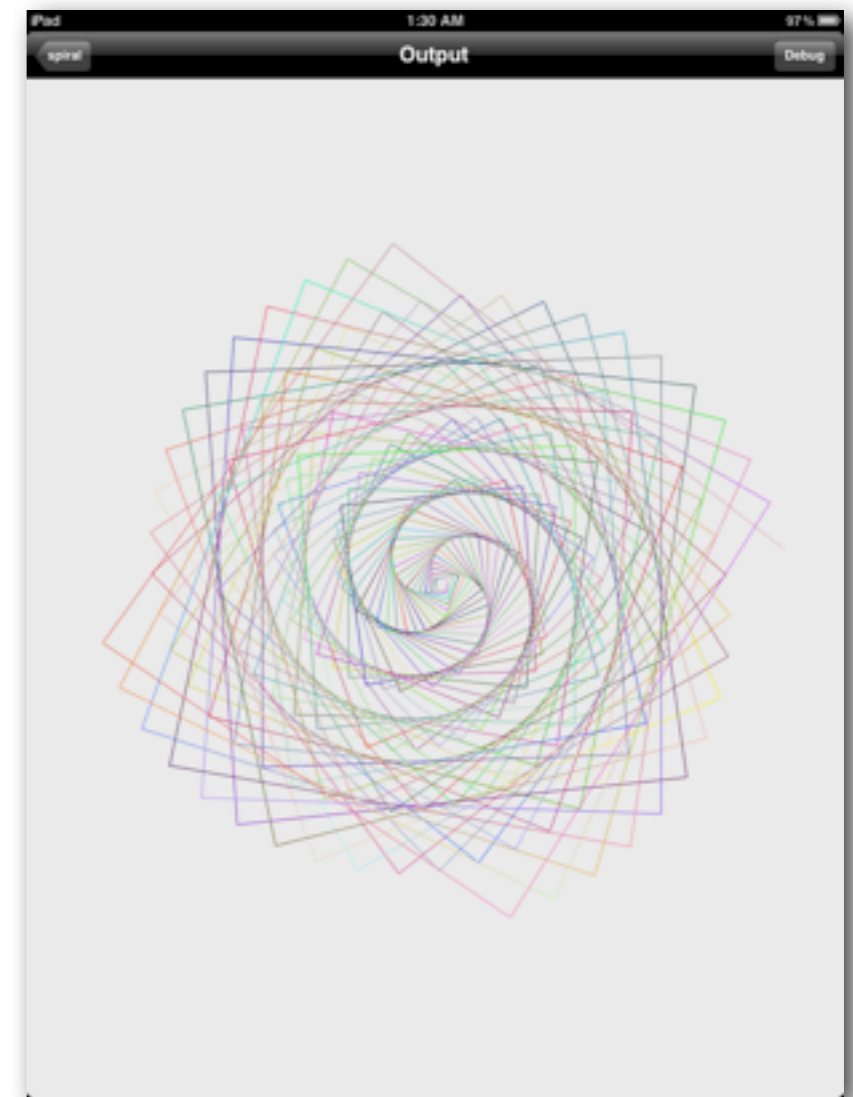
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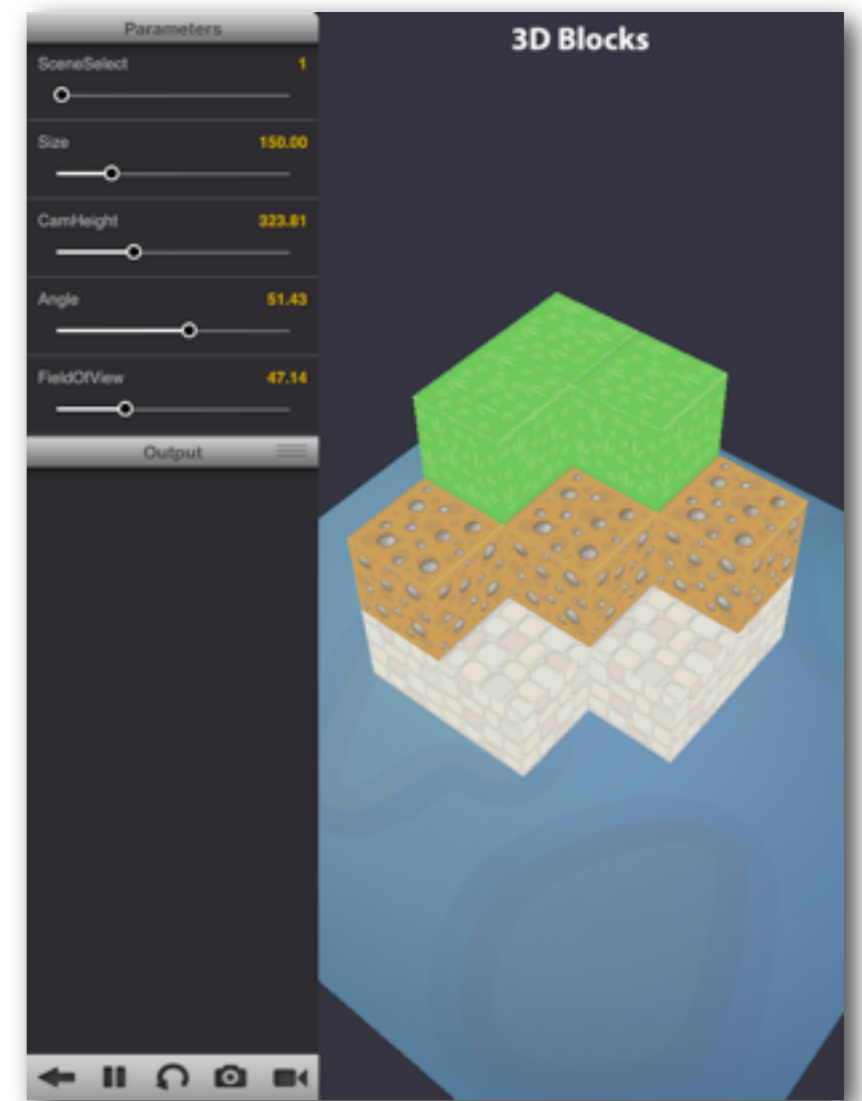
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Mathematics II

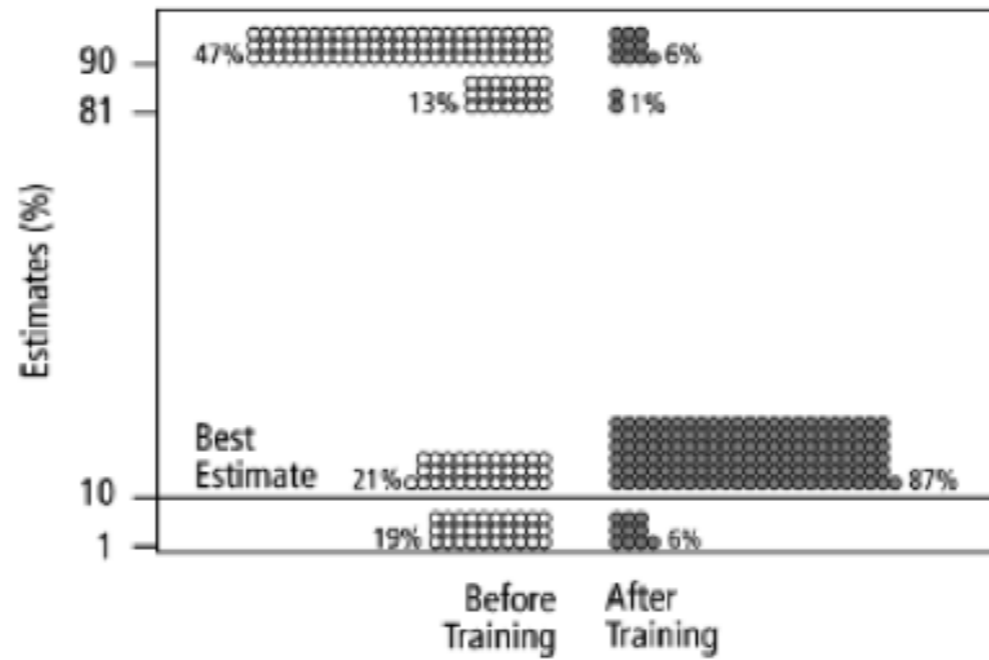


Fig. 2. Estimates by 160 gynecologists of the probability that a woman has breast cancer given a positive mammogram, before and after receiving training in how to translate conditional probabilities into natural frequencies.

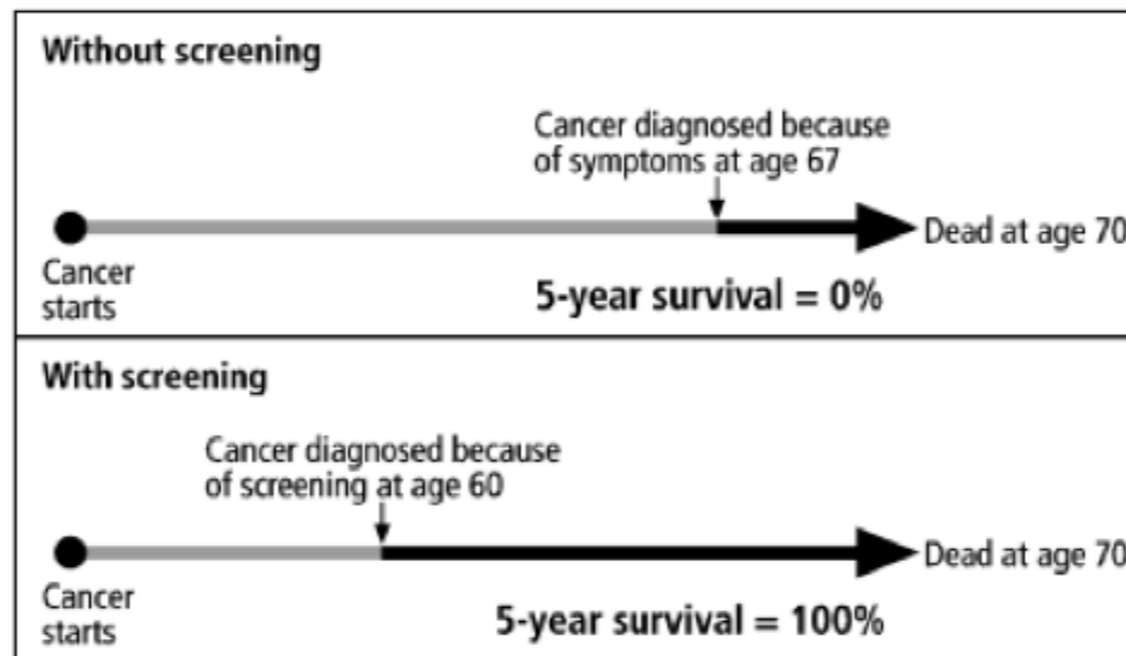


Fig. 4. Lead-time bias. Even if the time of death is not changed by screening—and thus no life is saved or prolonged—advancing the time of diagnosis in this way can result in increased 5-year survival rates, causing such statistics to be misleading.

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The screenshot shows a web page with a navigation sidebar on the left and a main content area. The main content area is titled "AP Statistics Curriculum 2007 Bayesian Prelim" and contains a "Contents" table of contents, a "Probability and Statistics Ebook - Bayes Theorem" section, an "Introduction" section, an "Example" section, and a "Bayesian Statistics" section. The "Introduction" section defines Bayes Theorem and provides the formula $P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$. The "Example" section provides a word problem about a laboratory blood test and shows the calculation for $P(D|T)$.

Navigation sidebar:

- View Page
- Community portal
- Current events
- Recent changes
- Random page
- Help
- Conditions
- Keyword Search
- Create Account

Search:

Toolbox:

- What links here
- Related changes
- Special pages
- Printable version
- Permanent link

Page title: AP Statistics Curriculum 2007 Bayesian Prelim

Contents (144)

- 1 Probability and Statistics Ebook - Bayes Theorem
 - 1.1 Introduction
 - 1.2 Example
 - 1.3 Bayesian Statistics
- 2 See also
- 3 References

Probability and Statistics Ebook - Bayes Theorem

Introduction

Bayes Theorem, or "Bayes Rule" can be stated succinctly by the equality

$$P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$$

In words, "the probability of event A occurring given that event B occurred is equal to the probability of event B occurring given that event A occurred times the probability of event A occurring divided by the probability that event B occurs."

Bayes Theorem can also be written in terms of densities or likelihood functions over continuous random variables. Let's call $f(\cdot)$ the density (or in some cases, the likelihood) defined by the random process x . If X and Y are random variables, we can say

$$f(Y|X) = \frac{f(X|Y) \cdot f(Y)}{f(X)}$$

Example

Suppose a laboratory blood test is used as evidence for a disease. Assume $P(\text{positive Test}|\text{Disease}) = 0.95$, $P(\text{positive Test}|\text{no Disease}) = 0.01$ and $P(\text{Disease}) = 0.005$. Find $P(\text{Disease}|\text{positive Test})$?

Denote $D = \{\text{the test person has the disease}\}$, $D^c = \{\text{the test person does not have the disease}\}$ and $T = \{\text{the test result is positive}\}$. Then

$$P(D|T) = \frac{P(T|D)P(D)}{P(T)} = \frac{P(T|D)P(D)}{0.95 \times 0.005 + 0.01 \times 0.995} = \frac{0.95 \times 0.005}{0.95 \times 0.005 + 0.01 \times 0.995} = 0.3231293.$$

Bayesian Statistics

What is commonly called **Bayesian Statistics** is a very special application of Bayes Theorem.

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How good is the test in detecting the disease?
P(positive test|sick): 0.062


How good is the test in detecting the absence of the disease?
P(negative test|healthy): 0.142

How likely is the disease?
P(disease): 0.001

Number of people for reference
N: 2329

Probability of being sick after having tested positive for a disease: $P(\text{sick} \text{positive test})$			
	positive test	negative test	Total
sick	0	2	2
healthy	1997	330	2327
Total	1997	332	2329

$P(\text{sick}|\text{positive test}): 0/1997 = 0.$

Wolfram  Demonstrations Project demonstrations.wolfram.com

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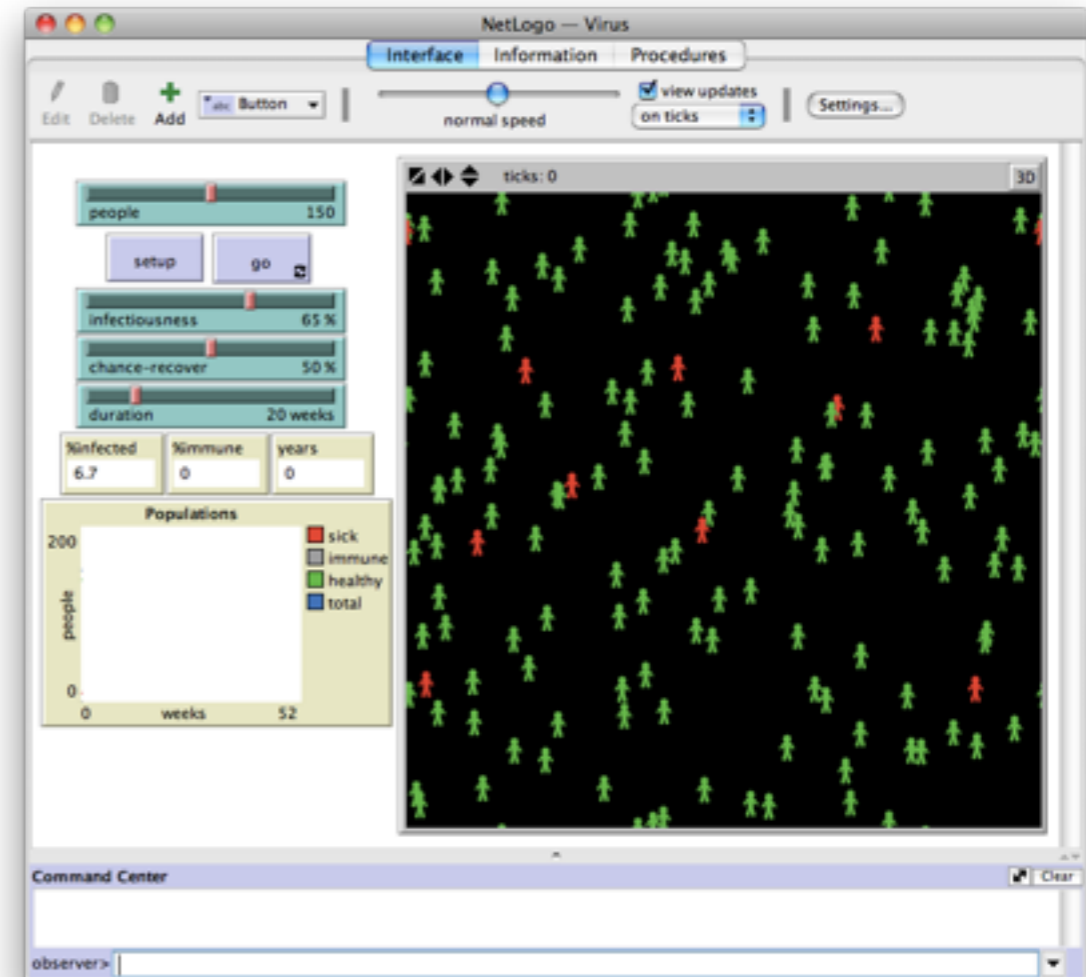
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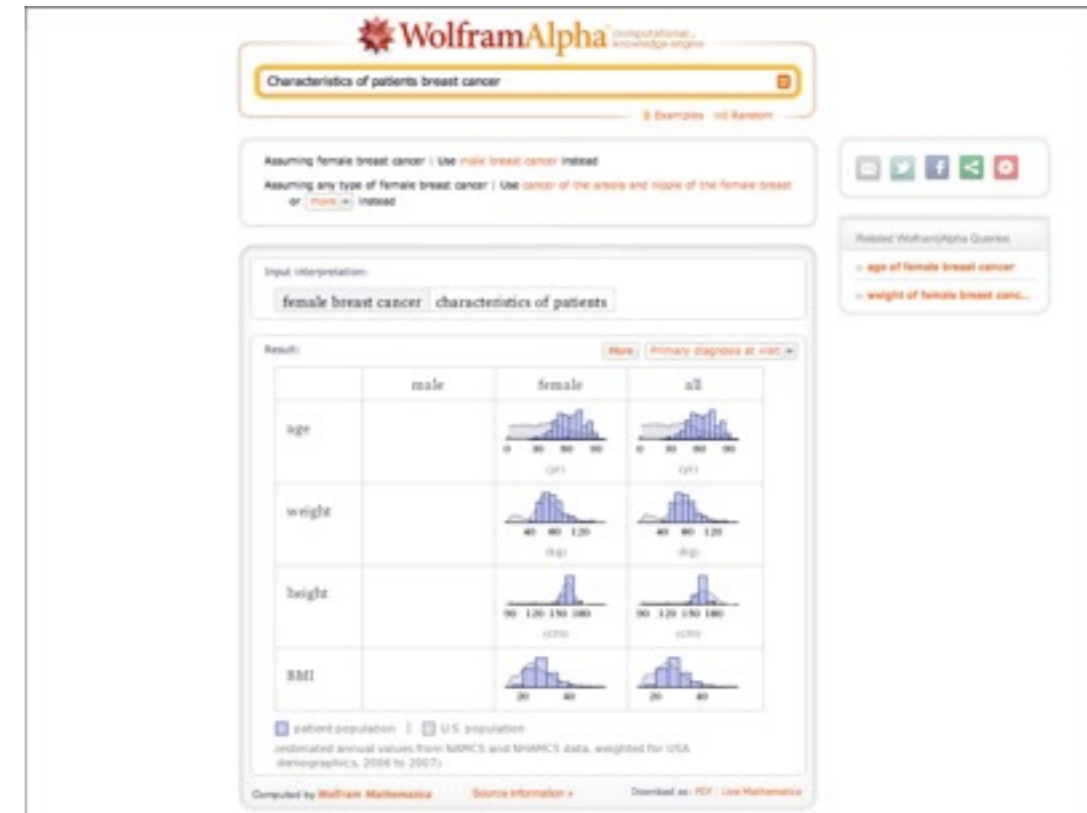
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Music

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The image shows a screenshot of a music application on an iPad. The title of the piece is "Stille Nache" by Franz Gruber. The score is displayed for four vocal parts: Soprano, Alto, Tenor, and Bass. The lyrics are "Stille Nacht, Heilige Nacht". The application interface includes a piano keyboard at the bottom, a control bar with various icons (play, stop, volume, etc.), and a status bar at the top showing the time as 4:40 PM and 55% battery. The background is a light yellow color.

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Challenge Based Learning

Class

Homework



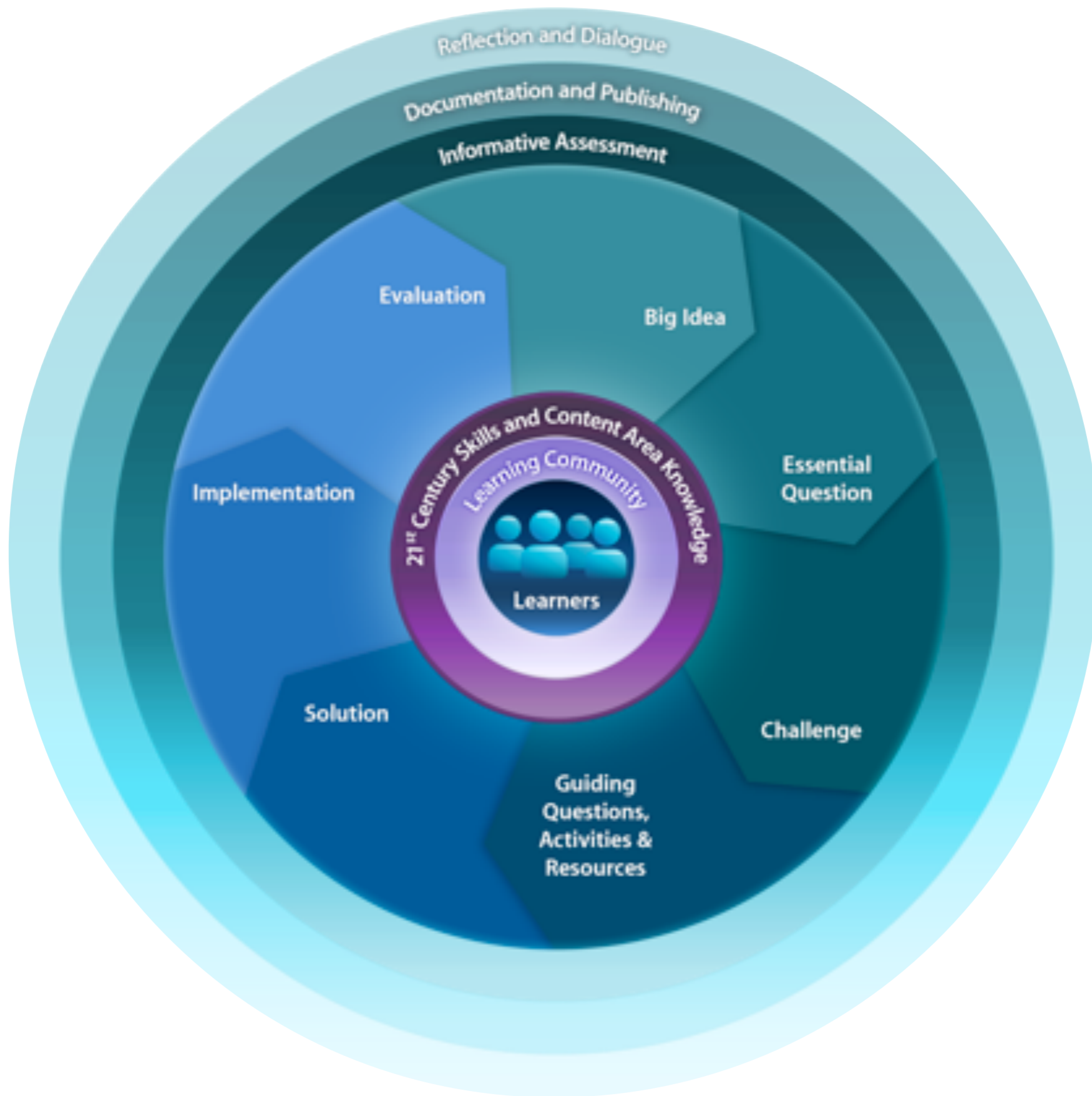
School

World

Home



Learning Environments



The CBL Process

Collaborative Space

- How will the teams communicate?
- Where will resources be shared?

Introduction

- Why is this idea important to the students?
- Why is this idea important to the community?

Team Formation

- What makes up a productive design team?
- How do we capitalize on everyone's skills?

Assessment

- How will the process be assessed?
- How will the solution be assessed?

Guiding Questions

- What do we need to know in order to meet the challenge?

Guiding Activities

- What do we need to do to answer our guiding questions?
- What resources are needed?

Solution Development

- How do we meet the challenge?
- Is the solution justified?

Implement and Assess

- How can the solution be tested?
- Did the solution work?

Document/Reflect

- What did we learn?
- What would we do differently?

Publish

- How do we share our results?
- What is the story behind the solution?

Additional Resources

Resources

Background:

- Vannevar Bush, “As We May Think”. *The Atlantic Monthly*. (July 1945) Online at: <http://www.theatlantic.com/magazine/archive/1969/12/as-we-may-think/3881/>
- Douglas C. Engelbart, *A Research Center for Augmenting Human Intellect*. (December 1968 live demo) Archived online at: <http://sloan.stanford.edu/mousesite/1968Demo.html>
- Alan Kay, “A Personal Computer for Children of All Ages”. *Proceedings of the ACM National Conference*. Boston (August 1972) Online at: <http://www.mprove.de/diplom/gui/Kay72a.pdf>
- Seymour Papert, “On Making a Theorem for a Child”. *Proceedings of the ACM National Conference*. Boston (August 1972) Online at: <http://portal.acm.org/citation.cfm?id=569942>

SAMR and TPCK:

- Ruben R. Puentedura, *Transformation, Technology, and Education*. (2006) Online at: <http://hippasus.com/resources/tte/>
- Ruben R. Puentedura, *As We May Teach: Educational Technology, From Theory Into Practice*. (2009) Online at: <http://tinyurl.com/aswemayteach>
- *TPCK - Technological Pedagogical Content Knowledge*. (2008-2010) Online at: http://www.tpck.org/tpck/index.php?title=Main_Page
- AACTE (Eds.) *The Handbook of Technological Pedagogical Content Knowledge for Educators*. New York:Routledge, 2008.

Resources – Part II

Defining Mobile Devices/The Lively Sketchbook

- Ruben R. Puentedura, “Drawing On The Lively Sketchbook”. *Connect@NMC Talks*. (2010) Online at: <http://www.nmc.org/connect/2010/april/16>
- Ruben R. Puentedura, “The Lively Sketchbook”. (2010) Online at: http://www.hippasus.com/rrpweblog/archives/2010_01.html

The Curiosity Amplifier

- John Seely Brown. “A New Culture of Learning”. NMC Summer Conference, Closing Keynote. (2010) Online at: <http://www.nmc.org/2010-summer-conference/jsb-keynote-video>

Technology In Education: The First 200,000 Years

- Ruben R. Puentedura. “Technology In Education: The First 200,000 Years”. NMC Summer Conference, *Ideas that Matter* Presentation. (2012) Online at: <http://www.hippasus.com/rrpweblog/archives/000069.html>

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