



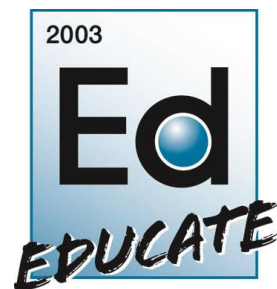
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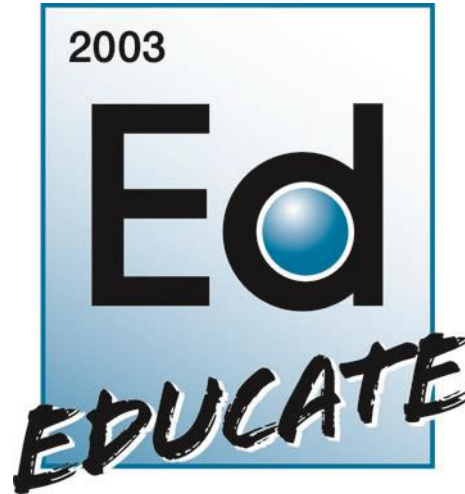
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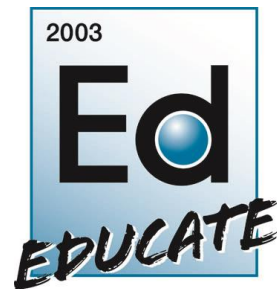


# Mathematical Solutions to Rising Global Health Issues: Authentic Problem-Based Learning



National Council of Teachers of Mathematics 2013  
Annual Meeting and Exposition

**Mission:** iBIO's mission is to make Illinois and the surrounding Midwest one of the world's top life sciences centers: a great place to do business and a great place to grow new technology ventures.



iCON



**Talent**  
**Sparks!**

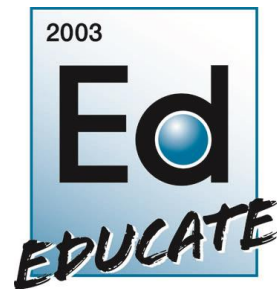


**Talent**  
**Sparks!**



**Illinois Innovation  
Talent Project: ILIT**

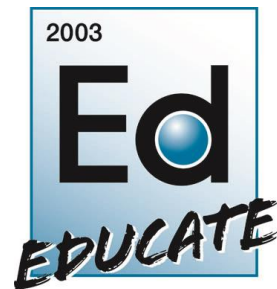
**stellargirls**



# EDUCATE Center Goals

## Program Goals:

- Connect Illinois classrooms with the “real world” of biotechnology and science-based industry
- Encourage student interest in STEM studies and STEM careers
- Facilitate interdisciplinary skill building for students and educators
- Model replicable, hands-on activities and inquiry- and problem-based learning experiences to increase these practices in the classroom
- Demonstrate real-world applications of STEM and network with industry professionals
- Provide resources to help both teachers and students develop 21<sup>st</sup> century skills and to implement the common core and next generation science standards.

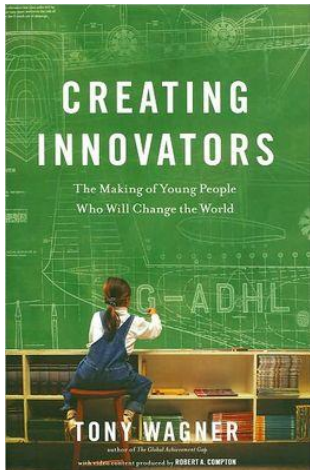


# Teaching and Learning in the 21<sup>st</sup> Century

Wall Street Journal Article April 13, 2012, 6:18 p.m. ET

**“Educating the Next Steve Jobs: How can schools teach students to be more innovative? Offer hands-on classes and don't penalize failure”** By [TONY WAGNER](#)

*Most of our high schools and colleges are not preparing students to become innovators. To succeed in the 21st-century economy, students must learn to analyze and solve problems, collaborate, persevere, take calculated risks and learn from failure. To find out how to encourage these skills, I interviewed scores of innovators and their parents, teachers and employers. What I learned is that young Americans learn how to innovate most often despite their schooling—not because of it.*

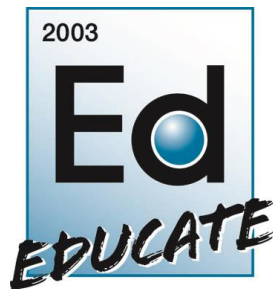


*Creating Innovators* (2012), Tony Wagner

**Also check out:**

*That Used to Be Us* (2011), T. Friedman  
and M. Mandelbaum

*Drive* (2009), Daniel Pink



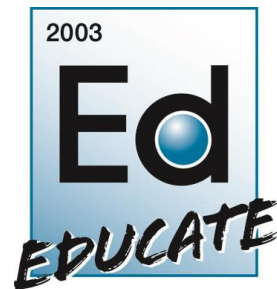
# Teaching and Learning in the 21<sup>st</sup> Century

## The Framework for 21<sup>st</sup> Century Learning

*The Partnership for 21st Century Skills has developed a vision for student success in the new global economy*

*<[www.p21.org](http://www.p21.org)>:*

- Core Subjects and 21st Century Themes
- Learning and Innovation Skills
- Information, Media and Technology Skills
- Life and Career Skills



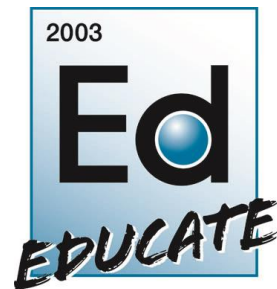
# Teaching and Learning in the 21<sup>st</sup> Century

## The Framework for 21<sup>st</sup> Century Learning

### Core Subjects and 21st Century Themes

*Mastery of core subjects and 21st century themes is essential to student success. In addition, schools must promote an understanding of academic content at much higher levels by weaving 21st century interdisciplinary themes into core subjects:*

- Global Awareness
- Financial, Economic, Business and Entrepreneurial Literacy
- Civic Literacy
- Health Literacy
- Environmental Literacy





# Teaching and Learning in the 21<sup>st</sup> Century

## The Framework for 21<sup>st</sup> Century Learning

**Learning and Innovation Skills**, which include:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration  
(a.k.a. “The 4 Cs”)

# Teaching and Learning in the 21<sup>st</sup> Century

## The Framework for 21<sup>st</sup> Century Learning

**Learning and Innovation Skills**, which include:

**“The 4 Cs”**

# Teaching and Learning in the 21<sup>st</sup> Century

## The Framework for 21<sup>st</sup> Century Learning

**Information, Media and Technology Skills**, such as:

- Information Literacy
- Media Literacy
- ICT (Information, Communications and Technology) Literacy

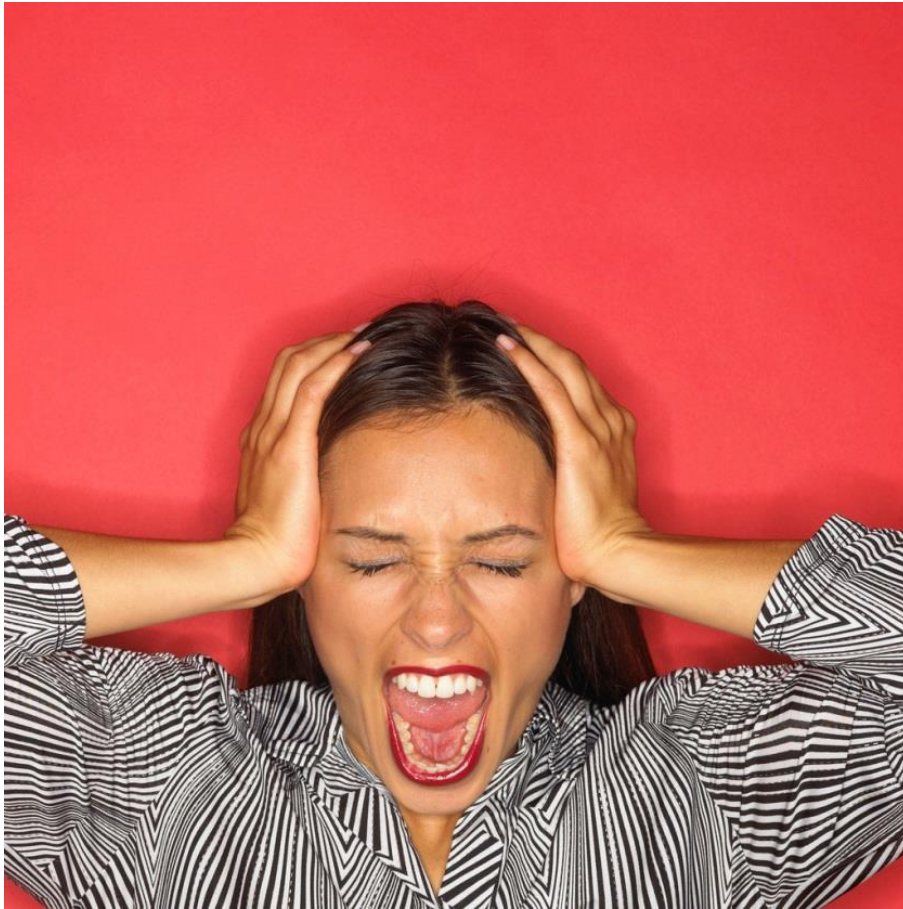
# Teaching and Learning in the 21<sup>st</sup> Century

## The Framework for 21<sup>st</sup> Century Learning

**Life and Career Skills**, such as:

- Flexibility and Adaptability
- Initiative and Self-Direction
- Social and Cross-Cultural Skills
- Productivity and Accountability
- Leadership and Responsibility

# Ughhh...So Many Frameworks and Standards!



*Where will we find the time and energy to do all of this?*





**The I's Have It!**

A close-up photograph of a person's face, focusing on the eyes and nose. The person has light skin and blue eyes. Four fingers are visible, pulling at the skin around the eyes, creating a wide-eyed, intense expression. The text is overlaid on the center of the face.

**I need**

Inspiration

Integration

Interdisciplinary

Inquiry

Investigation

**to**

Interpret

Imagine

Innovate

Invent

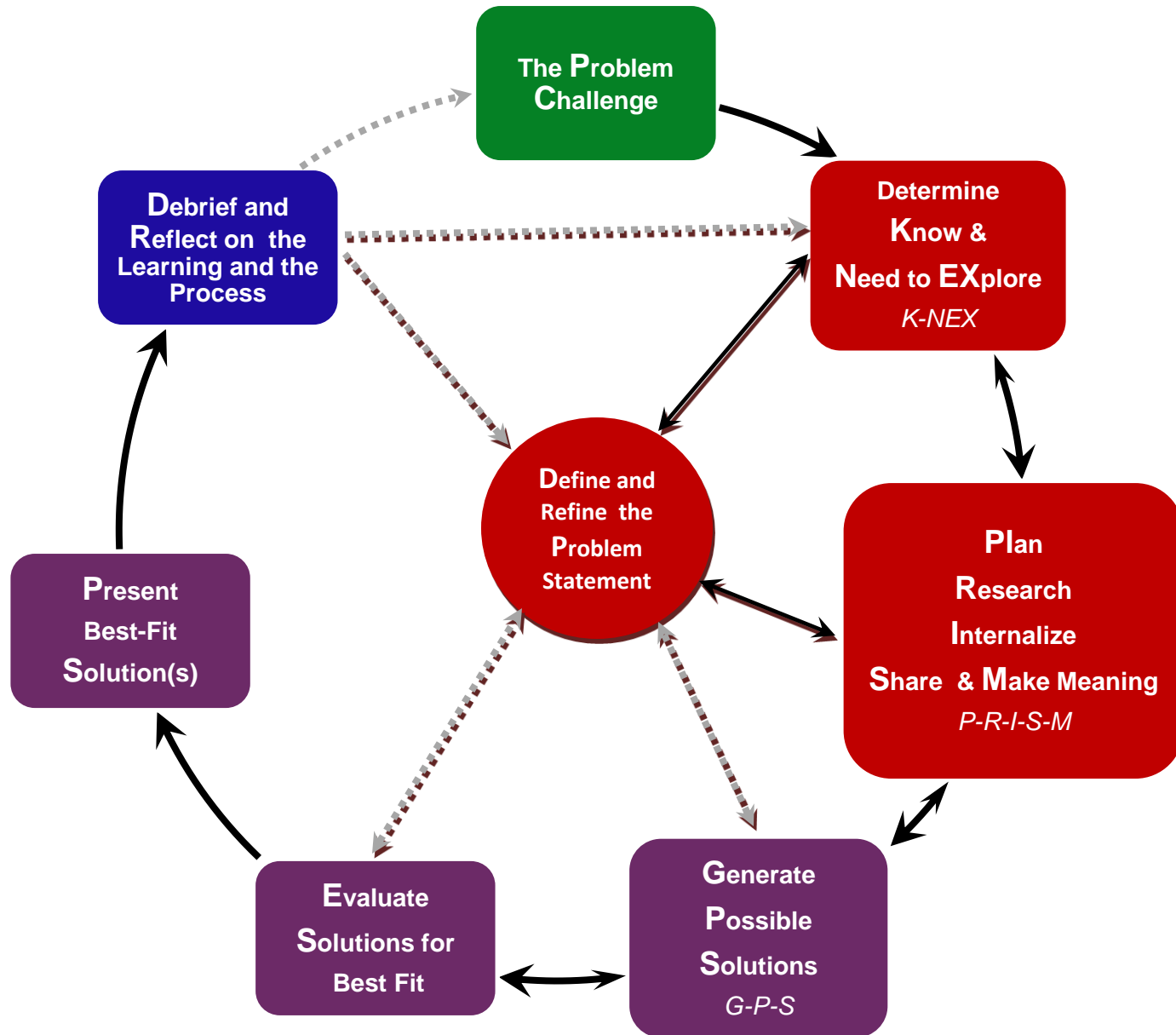




**Authentic**  
**Problem-Based**  
**Learning**  
**and**  
**Visible**  
**Thinking**



# A Problem-Based Learning Cycle

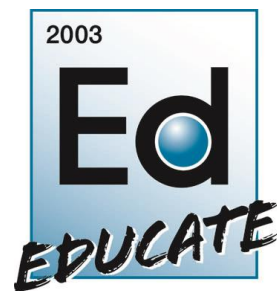




## MSP WIPIII Program

Partnership with Monroe-Randolph Regional Office of Education (ROE#45)  
and Illinois State University

- Major program elements:
  - Alignment with Common Core & Next Generation Science Standards
  - Hands-on laboratory skills / biotech focus
  - Practical application of skills by industry
  - Explore real-world problems
  - Inquiry and problem-based learning (PBL)
  - Career exploration



# Quick Stats for MSP WIP III

- 80 hours of professional development during both Summer 2011 and Summer 2012
- Minimum of 32 hours of professional development during academic years 2011-12 and 2012-13
- 25 teachers / upstate and downstate—HS teachers of mathematics, science, business, agriculture, health/PE, family consumer sciences, and social studies



- Over 20 industry and academic partners each year, with over 30 individual partner member participants
- 2-week summer workshops focus on one real-world problem.
- EDUCATE's "BIOSTEM," Industry-Educator Advisory Council helps guide program development.
- External evaluator assesses professional development, teacher content growth, pedagogical shifts, teacher implementation, student achievement and sustainability.



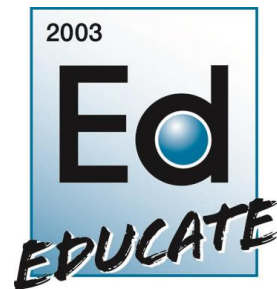
## PBL Challenge 2011:

# Addressing the Global Obesity Epidemic at a Community Level

## Industry/Academic Partners 2011

- Abbott Laboratories\*
- Archer Daniels Midland Company
- Astellas Pharma US\*
- Baxter International\*
- Children's Memorial Hospital
- Dairy House
- Donald Danforth Plant Science Center
- Dunbar Vocational Career Academy
- Illinois Association for Gifted Children
- Illinois Mathematics and Science Academy\*
- Milwaukee School of Engineering
- Monsanto\*
- Mount Assisi Academy
- Northwestern University\*
- Prairie Farms
- Red Bud High School
- Roosevelt University\*
- Southern Illinois University Edwardsville\*
- Takeda Pharmaceuticals North America\*
- Tate & Lyle\*
- Truman College
- University of Chicago

\*denotes BIOSTEM Advisory Committee participation



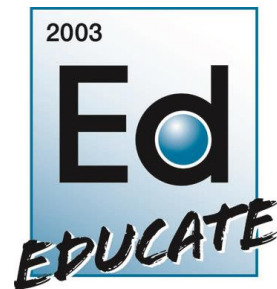


PBL Challenge 2012:

## Changing Climate and the Effects on Human Health and Agriculture

### Industry/Academic Partners 2012

- Returning and new companies and academic partners participated in program.
- New participants included:
  - Argonne National Lab\*
  - Consumer Energy Alliance,
  - DaVinci Academy
  - Dynergy Power Plant
  - Hospira
  - Illinois Department of Public Health/Centers for Disease Control
  - Illinois Energy Council
  - Peabody Energy Gateway Mines
  - Northern Illinois University
  - Randolph County Farm Bureau







## Updates in 2012-2013

- Added one new school—Instituto Health Science Careers Academy (IHSCA)\*
- This year 15 of the teachers have implemented at least one PBL in their classrooms, the remaining teachers are currently finishing designing theirs, and a few teachers will be implementing at least two PBL units in their classrooms.
- IHSCA is framing their curricula for all grades around the Changing Climate...
- Changing Health problem. Continuing support of teachers through classroom observations, mentoring, and professional development and lesson studies
- Continuing working on sustainability – fostering teacher collaboration with industry, community, and academic research partners and with each other
- Some TalentSparks<sup>3</sup> teachers (from Chicago High School for Agricultural Sciences, Evanston Township High School, and Maine Township High School cofacilitated this summer's PBL experience for teachers.
- **Several teachers are using Visible Thinking Routines to develop a Culture of Thinking in their Classrooms.**



# What is a Visible Thinking Routine?

(Reference: Harvard's Project Zero *Visible Thinking* web site

[http://www.old-pz.gse.harvard.edu/vt/VisibleThinking\\_html\\_files/03\\_ThinkingRoutines/03a\\_ThinkingRoutines.html](http://www.old-pz.gse.harvard.edu/vt/VisibleThinking_html_files/03_ThinkingRoutines/03a_ThinkingRoutines.html) )

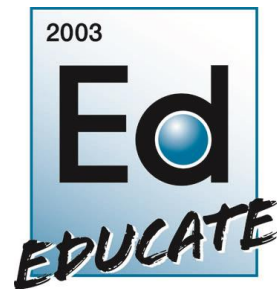
*Thinking routines form the core of the Visible Thinking program.*

*What makes these routines work to promote the development of a students' thinking and the classroom culture are that each routine:*

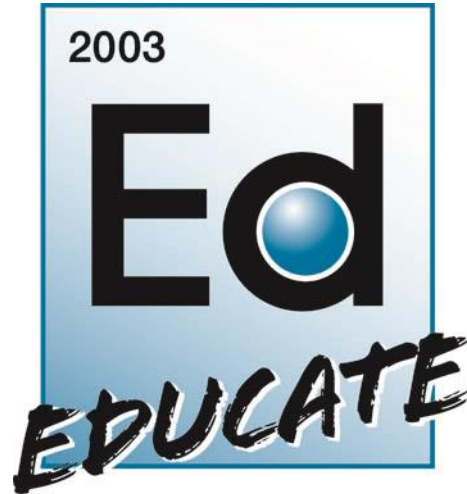
- Is goal oriented*
- Gets used over and over again in the classroom*
- Consists of only a few steps*
- Is easy to learn and teach*
- Is easy to support when students are engaged in the routine*
- Can be used across a variety of contexts*
- Can be used by the group or by the individual*

The routines support 4 thinking ideals:

*creativity, truth, fairness, & understanding*



# The Obesity Epidemic: Challenges and Opportunities



Doriane C. Miller, MD  
Director, Center for Community Health and Vitality  
University of Chicago Medical Center

iBIO Institute, EDUCATE Center  
Roosevelt University  
July 12, 2011



# The Problem Challenge

**How can we address the global obesity epidemic at a community level based on current scientific knowledge and research and development; complexity and inter-related factors; role of public policy and community issues?**



# OBESITY AND BODY MASS INDEX

## Definitions

- *Obesity*: Body mass index (BMI) of 30 or higher.
- *Body mass index (BMI)*: A measure of an adult's weight in relation to his or her height, specifically the adult's weight in kilograms divided by the square of his or her height in meters.

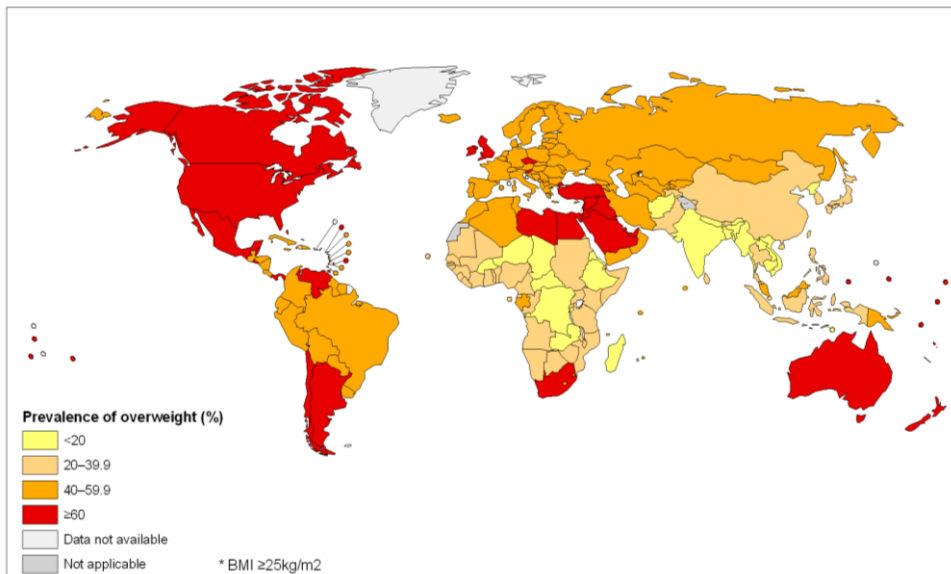
# Visible Thinking Routine

## SEE/THINK/WONDER

- What do you SEE?
- What do you THINK?
- What do you WONDER?

(Reference: Harvard's Project Zero *Visible Thinking* Routine: "See-Think-Wonder")

Prevalence of overweight\*, ages 20+, age standardized  
Both sexes, 2008

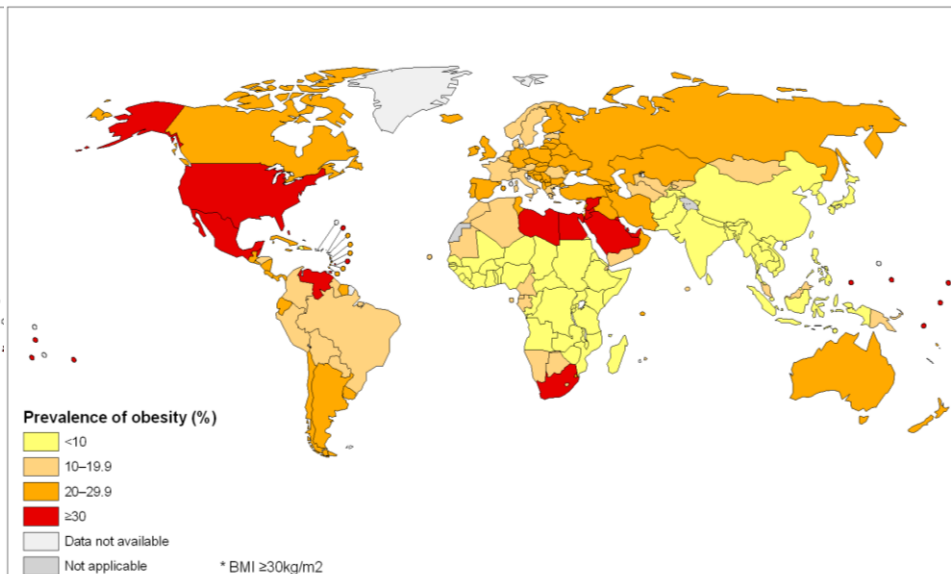


The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization  
Map Production: Public Health Information and Geographic Information Systems (GIS)  
World Health Organization

World Health Organization  
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Prevalence of obesity\*, ages 20+, age standardized  
Both sexes, 2008



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization  
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World Health Organization

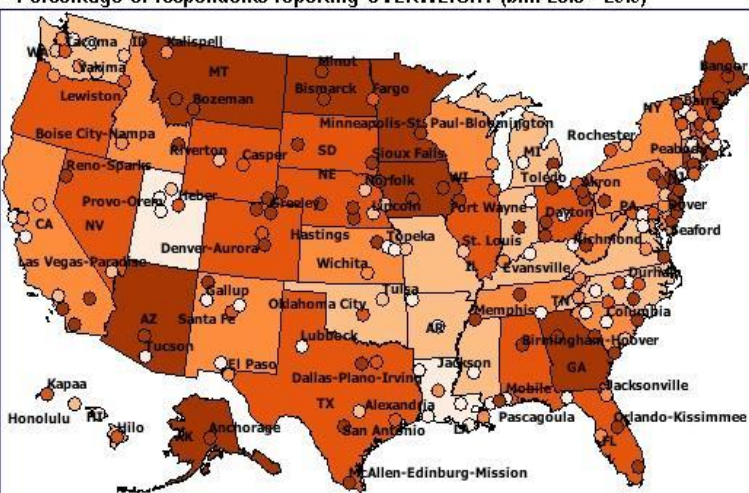
World Health Organization  
© WHO 2011. All rights reserved.

## BRFSS Maps

Year - 2009

Weight classification by Body Mass Index (BMI)

Percentage of respondents reporting OVERWEIGHT (bmi 25.0 - 29.9)

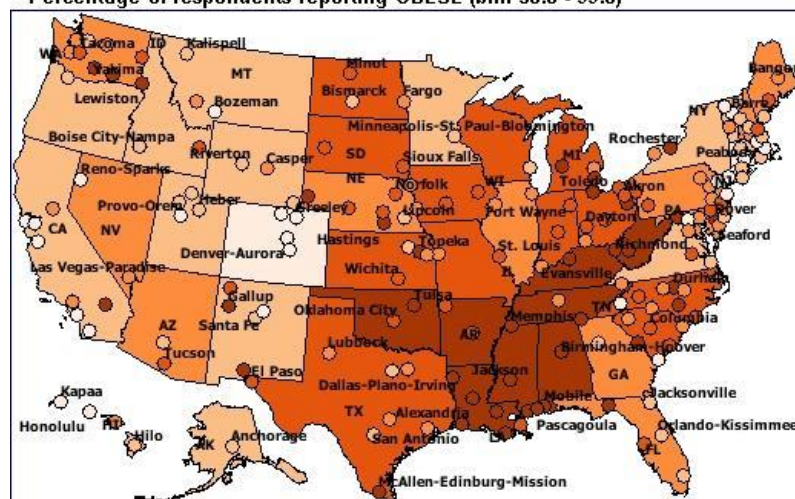


## BRFSS Maps

Year - 2009

Weight classification by Body Mass Index (BMI)

Percentage of respondents reporting OBESE (bmi 30.0 - 99.8)





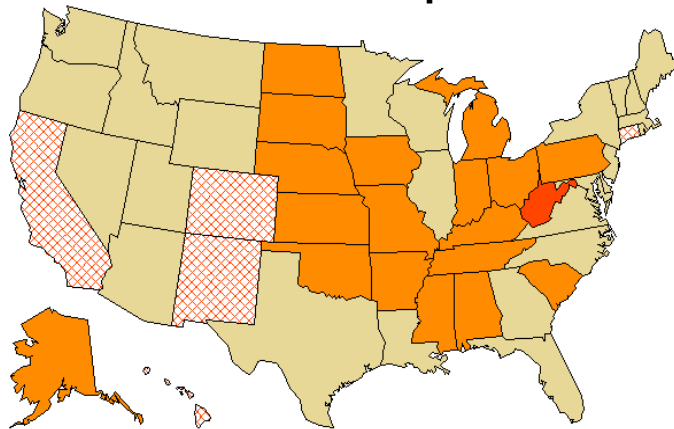
# State-specific Prevalence of Obesity Among U.S. Adults, by Race/Ethnicity, 2006-2008

## ***Methods:***

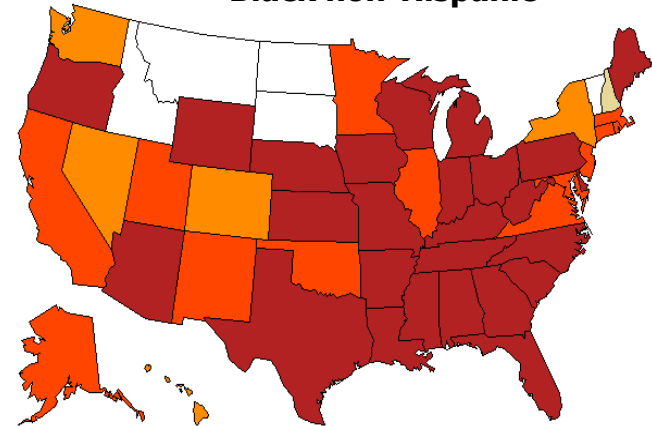
- Behavioral Risk Factor Surveillance System (BRFSS).
- Self-reported weights and heights.
- Limited to three years of data and limited to three racial/ethnic populations; non-Hispanic whites, non-Hispanic blacks, and Hispanics.
- Age-adjusted to the 2000 U.S. standard population.

# State-specific Prevalence of Obesity\* Among U.S. Adults, by Race/Ethnicity, 2006-2008

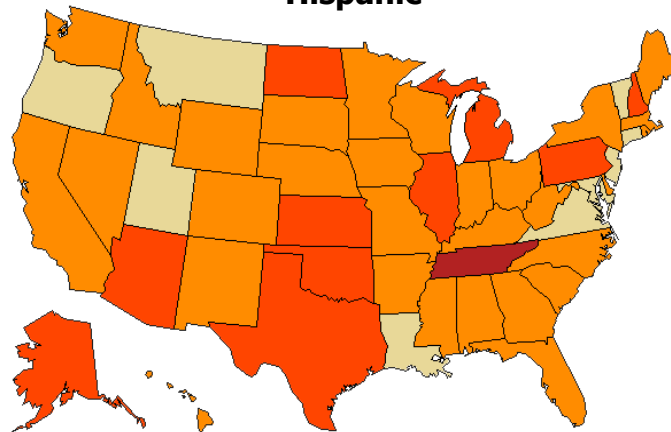
White non-Hispanic



Black non-Hispanic



Hispanic



(\*BMI  $\geq 30$ )

□ No sufficient sample\*\*  
■ 25–29

▨ < 20  
■ 30–34

■ 20–24  
■ 35+

# SMART BRFSS Prevalence Data

Chicago-Naperville-Joliet, IL-IN-WI Metropolitan Statistical Area 2009

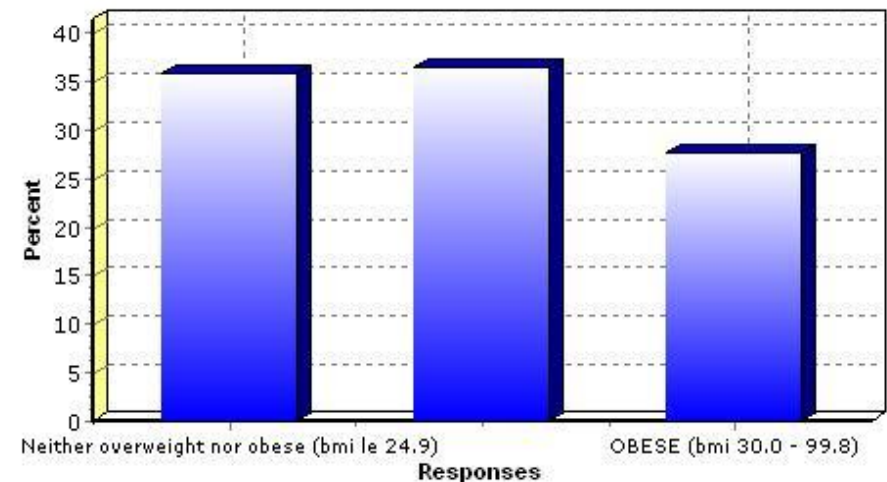
## Counties Included:

Cook, IL; DeKalb, IL; DuPage, IL; Grundy, IL; Jasper, IN; Kane, IL; Kendall, IL; Kenosha, WI; Lake, IL; Lake, IN; McHenry, IL; Newton, IN; Porter, IN; Will, IL

BRFSS question for Overweight and Obesity (BMI)

## Weight classification by Body Mass Index (BMI)

	Neither overweight nor obese (bmi ≤ 24.9)	OVERWEIGHT (bmi 25.0 - 29.9)	OBESE (bmi 30.0 - 99.8)
%	35.8	36.5	27.7
CI	(33.6 – 37.9)	(34.3 – 38.6)	(25.7 – 29.6)
n	1519	1590	1353

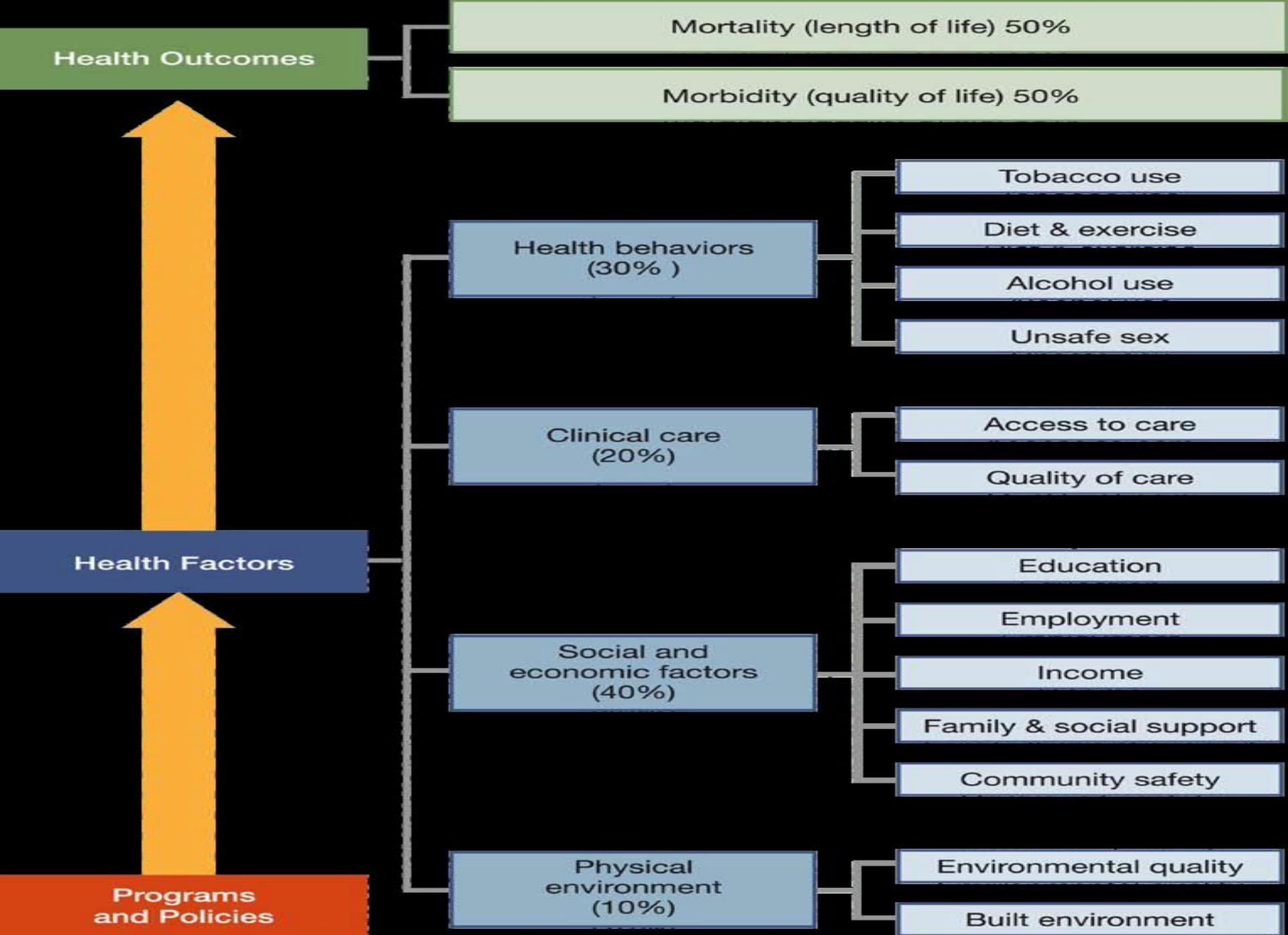


% = Percentage  
Percentages are weighted to population characteristics.

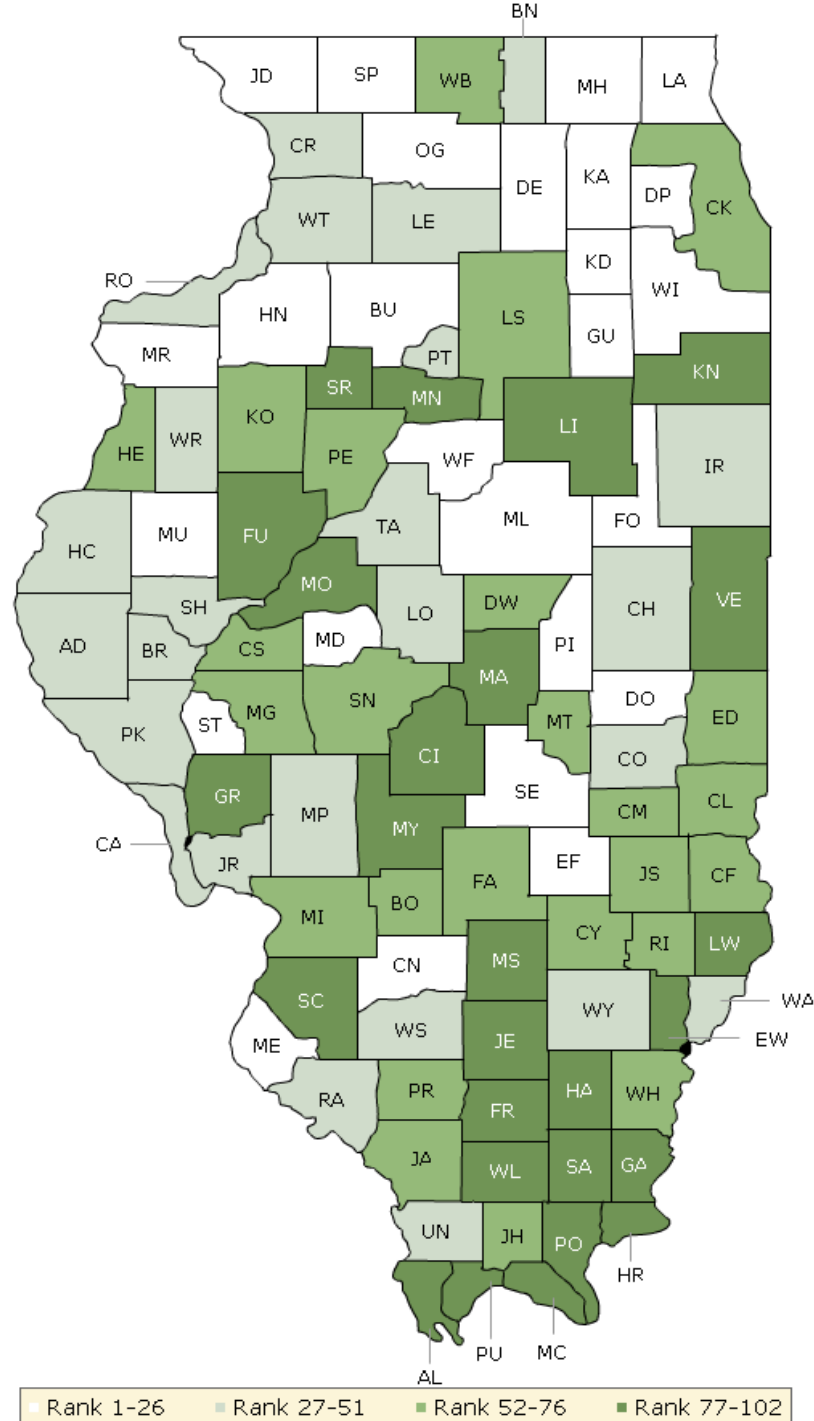
# Growth of Obesity in Youth

- Four fold growth in obesity rates in 40 years
- 1/3 of children overweight or obese
- 34.9% of black children vs. 30% of whites overweight or obese

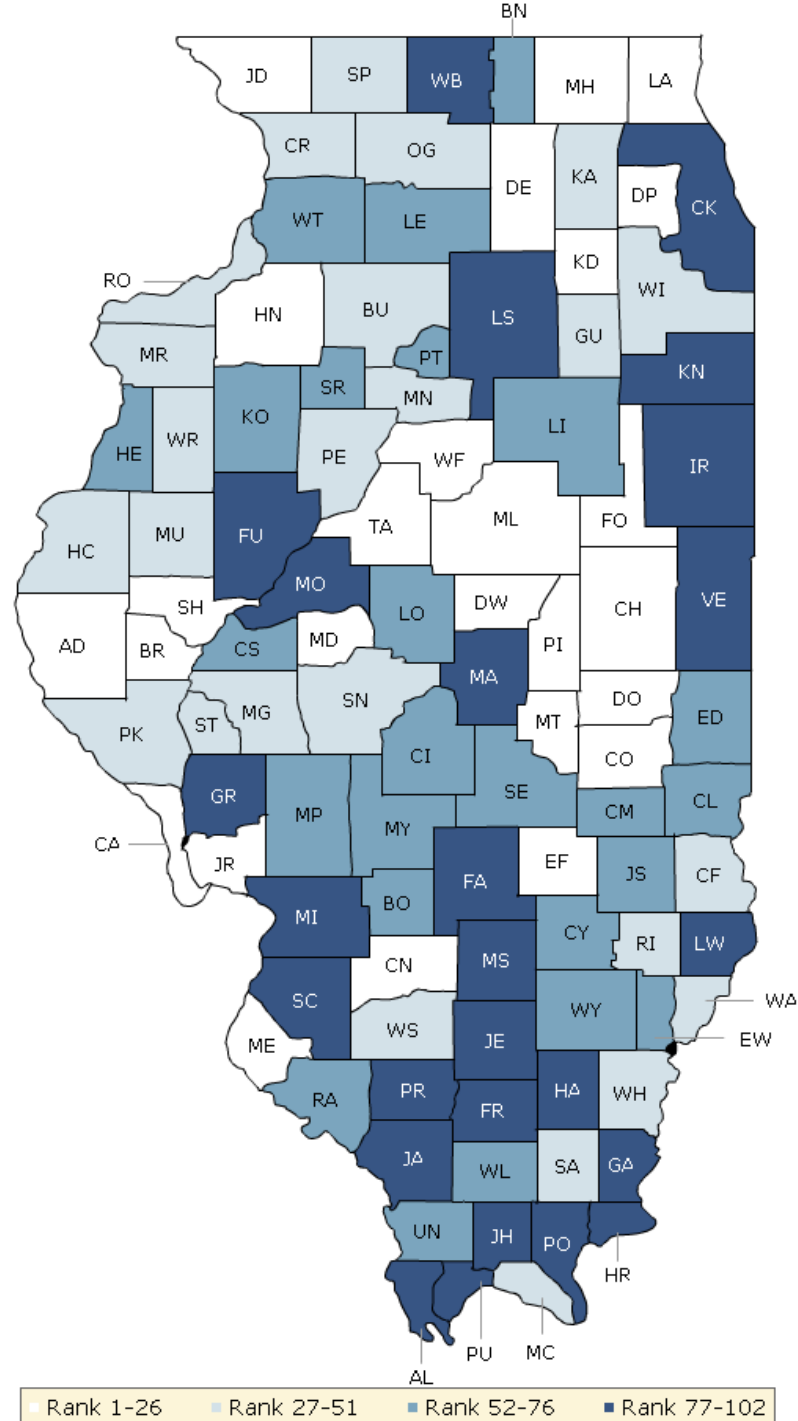




# IL Co. Ranking by Health Outcomes



# IL Co. Ranking by Health Factors



# References

- <http://www.rwjf.org/files/research/thepoorpaymore2009.pdf>
- <http://www.rwjf.org/reports/grr/040075.htm>
- <http://jama.ama-assn.org/cgi/content/abstract/295/20/2385>
- <http://www.cdc.gov/obesity/data/trends.html>
- <http://southsidehealth.org>
- [http://www.who.int/gho/ncd/risk\\_factors/overweight/en/](http://www.who.int/gho/ncd/risk_factors/overweight/en/)
- [http://www.countyhealthrankings.org/sites/default/files/states/CH\\_R2011\\_IL\\_0.pdf](http://www.countyhealthrankings.org/sites/default/files/states/CH_R2011_IL_0.pdf)

# The Obesity Epidemic: What Can We Do to Solve the Global Obesity Problem at a Community Level?

Based on

- **current scientific knowledge and research and development;**
- **complexity and inter-related factors;**
- **role of public policy and community issues?**

Recommendations?

# Determine What We Know and Need to Explore (K-NEX)

What do you Know

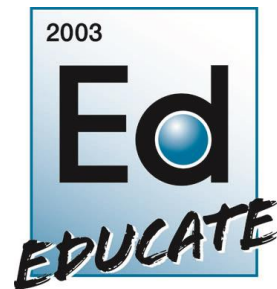
about the obesity epidemic?  
factors that contribute to the obesity epidemic?  
&

What do you think you know?

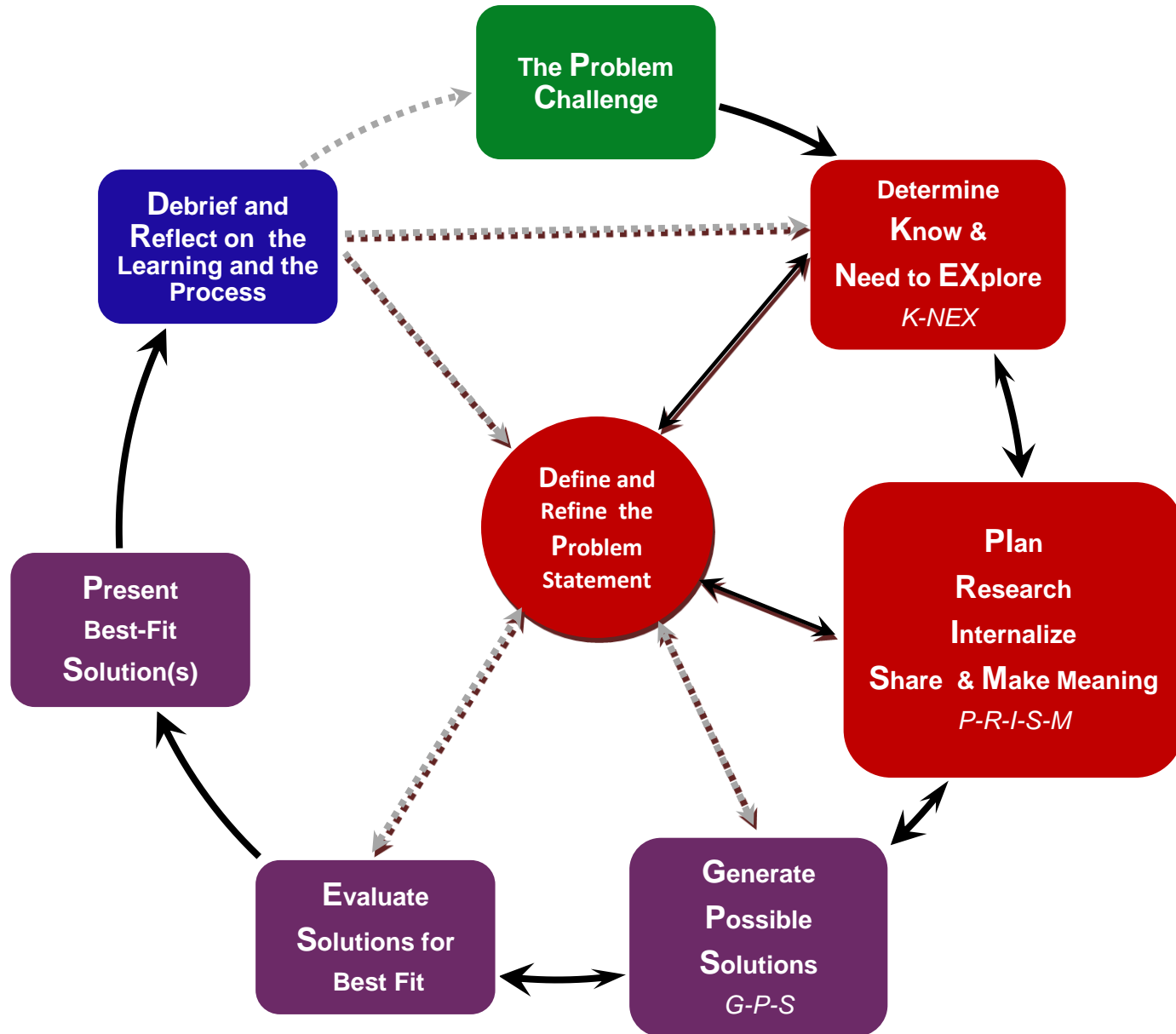
What do you puzzle about?

What do you Need to EXplore?

(Reference: Harvard's Project Zero *Visible Thinking* Routine: "Think-Puzzle-Explore")



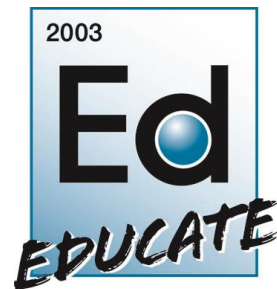
# A Problem-Based Learning Cycle



# Anticipated Initial “Knows”

## Know

- Obesity is body mass index (BMI) of 30 or higher
- BMI can be measured
- World Health Organization chart global overweight and obesity levels
- CDC charts state-specific prevalence of obesity
- CDC limits stats to three racial/ethnic populations: non-Hispanic whites, non-Hispanics blacks, and Hispanics
- CDC uses the Behavioral Risk Factor Surveillance System (BRFSS)
- SMART BRFSS charts metropolitan prevalence of obesity
- Obesity in youth has grown four fold in 40 years
- 1/3 of children are overweight or obese
- 34.9% of black children are overweight vs 30% of white children
- Factors of health include physical environment, social/economic, clinical care, and health behaviors





# Anticipated Initial “Need to Explore”

## Need to Explore

- Why are black children more obese than white children?
- Why is the obesity level rising?
- What are the factors of obesity?
- How are they inter-related?
- What related public policies are there?
- What can public policy do about obesity?
- What are the global connections to local problems?
- What are our local problems?
- What are the connections between poverty and obesity?
- How does obesity affect a person's health?
- What environmental factors impact obesity?
- What clinical care factors impact obesity?
- What are considered *healthy behaviors*?
- What role does genetics play in obesity?

# Define and Refine the Problem Statement

## Predicted Problem Definition with Factors:

In order to advise [our community leaders] on how to address the rising obesity problem [based on current scientific knowledge and research and development], we need to consider:

- Current trends—data and demographics
- Genetic inheritance and predispositions
- Personal behaviors/choices--exercise, food portions
- Nutrition
- Socio-economic and environmental factors
- Treatment methods
- Related non-communicable diseases
- Current policies
- Education
- Epigenetics (?)

# Use of Visible Thinking Routines

- Question Sorts Routine
- Generate, Sort, Connect, Elaborate: Concept Maps

(Reference: Harvard's Project Zero *Visible Thinking* Routines)

# Plan, Research, Investigate, Share and Make Meaning (*P-R-I-S-M*)

What Causes  
Obesity?



Genetics ...





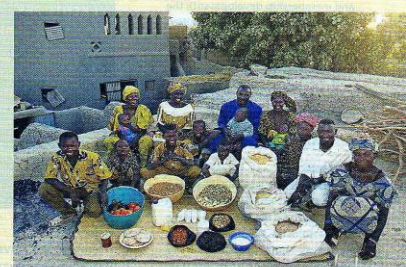
# P-R-I-S-M

It's environmental ...



Chicago Consortium for  
Lowering Obesity in  
Chicago's Children

Want to go for a walk?

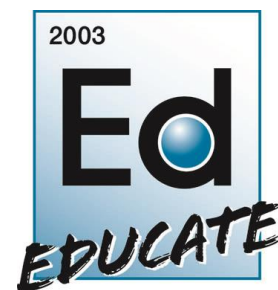
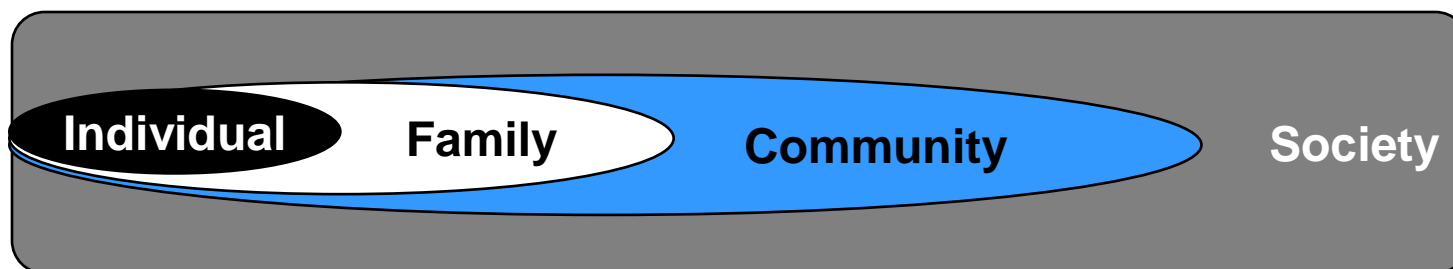


Four of the families pictured with a week's worth of food in the book *Hungry Planet*. Clockwise from top left: the Mendozas of Todos Santos Cuchumatán, Guatemala; the Cavens of American Canyon, California; the Natomos of Kouakourou, Mali; and the Dongs of Beijing, China.

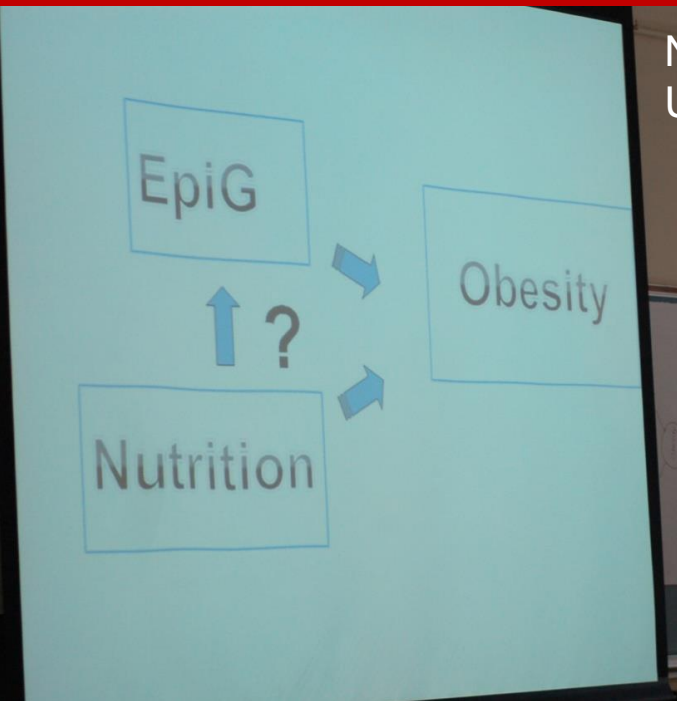
Sierra Club, 2006

We are what we eat...

An ecologic approach is required



# P-R-I-S-M



Northwestern  
University

It's both—and it's *epigenetic*!



Wait ... that's not in our  
text books...

What's an *epigenome*?



# P-R-I-S-M

A few resources for learning about epigenetics

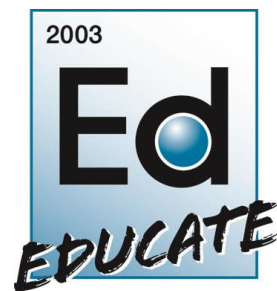
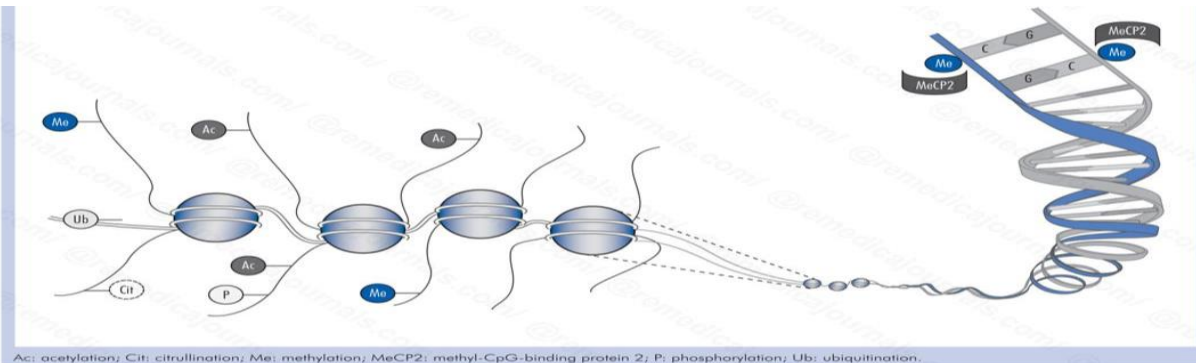
<http://www.pbs.org/wgbh/nova/body/epigenetics.html>

<http://learn.genetics.utah.edu/content/epigenetics/nutrition/>

Hands-on activities on the epigenome

[http://www.pbs.org/wgbh/nova/teachers/activities/3411\\_02\\_nsn.html](http://www.pbs.org/wgbh/nova/teachers/activities/3411_02_nsn.html)

<http://teach.genetics.utah.edu/content/epigenetics/>



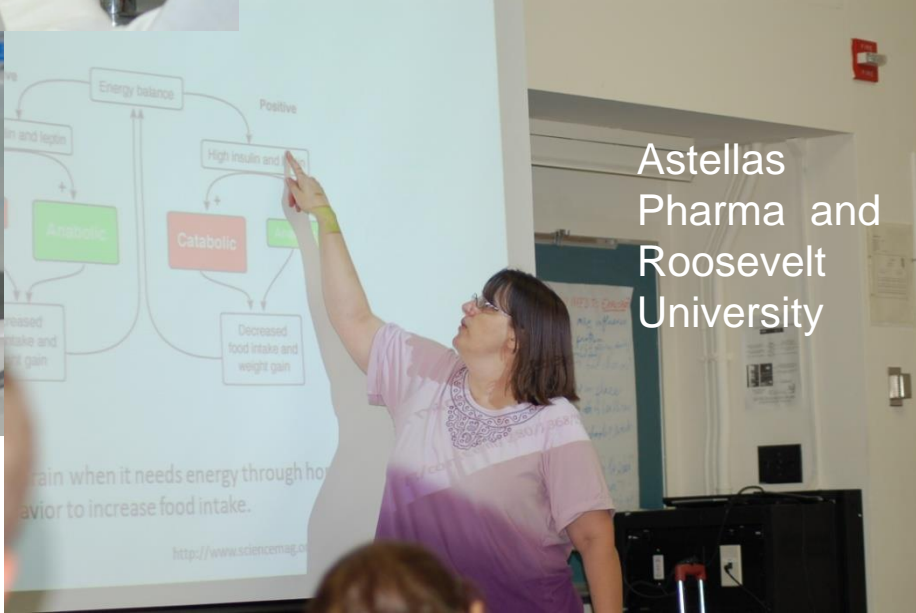
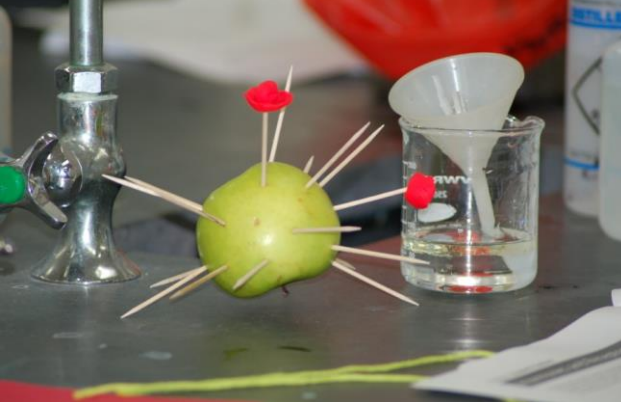


# P-R-I-S-M

What about hormones?



Milwaukee School of Engineering



Astellas  
Pharma and  
Roosevelt  
University

# P-R-I-S-M

The elusive magic pill...



What are the challenges?



# P-R-I-S-M

## Nutrition and Food Chemistry



Dairy House and Prairie Farms



# P-R-I-S-M

## Agriculture and plant biotechnology



ADM



SIUE



# P-R-I-S-M

## Integrated Technology for Collaborative Learning:

### Webinars

Abbott Nutrition (Ohio) and Tate and Lyle (Decatur)

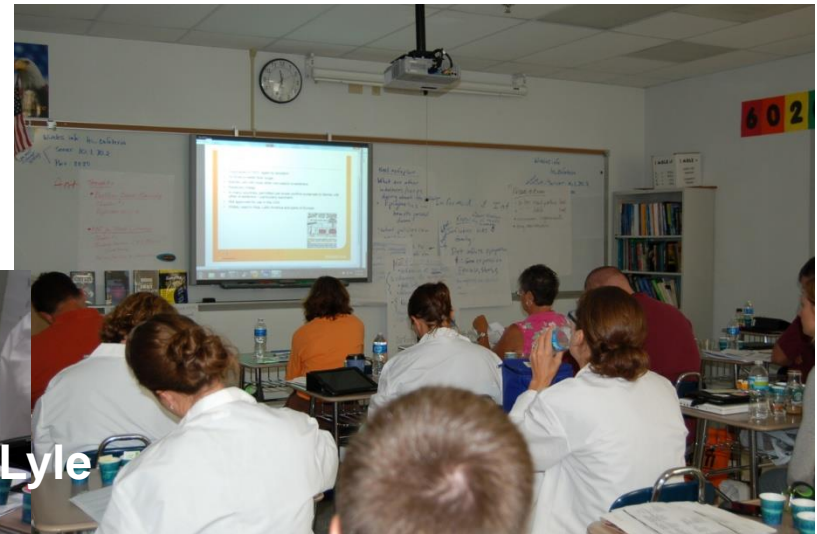
### IMSA's CoolHub

<coolhub.imsa.edu>

### iPADs



Tate and Lyle



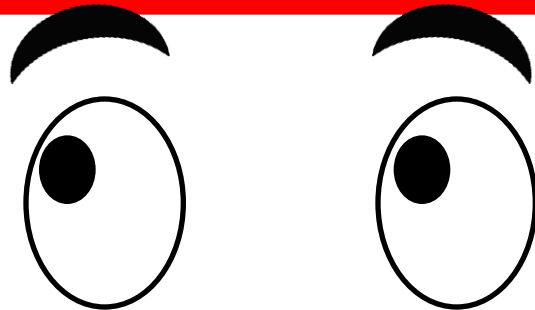
# More Visible Thinking Routines

- Think Pair Share
- What Makes You Say That?
- Connect/Extend/Challenge
- 3-2-1 Bridge
- Claim/Support/Question
- Stop Look Listen
- Circle of Viewpoints
- Step Inside: Perceive, Know about, Care About

(Reference: Harvard's Project Zero *Visible Thinking* Routines)



# So Where Is the Mathematics?





# It's All Over the Place!

## Interpreting Gel Electrophoresis Results from Epigenetics Lab

Nutrition Facts		
Serving Size 1 cup (228g)		
Servings Per Container about 2		
Amount Per Serving		
Calories 250	Calories From Fat 110	
	% Daily Value*	
Total Fat 12g	18%	
Saturated Fat 3g	15%	
Trans Fat		
Cholesterol 30mg	10%	
Sodium 470mg	20%	
Total Carbohydrate 31g	10%	
Dietary Fiber 0g	0%	
Sugars 5g		
Proteins 5g		
Vitamin A	4%	
Vitamin C	2%	
Calcium	20%	
Iron	4%	
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:		
	Calories:	2,000      2,500
Total Fat	Less than	65g      80g
Saturated Fat	Less than	20g      25g
Cholesterol	Less than	300mg      300mg
Sodium	Less than	2,400mg      2,400mg
Total Carbohydrate		300g      375g
Dietary Fiber		25g      30g

1 Serving Size

2 Amount of Calories

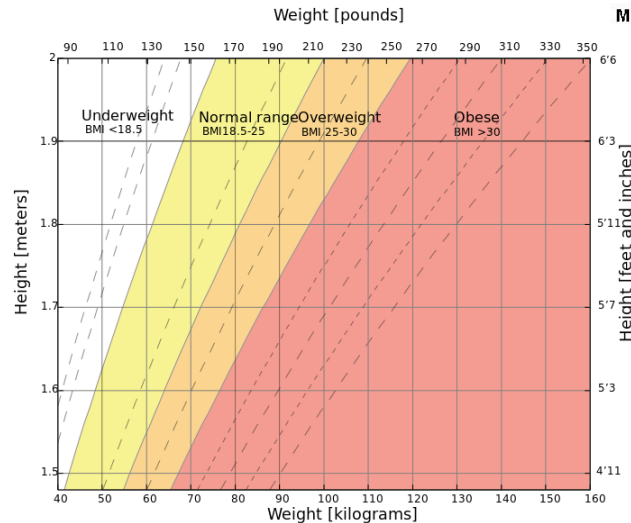
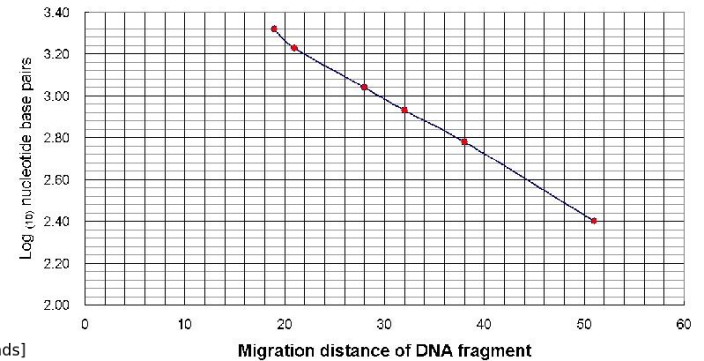
3 Limit these Nutrients

4 Get Enough of these Nutrients

5 Percent (%) Daily Value

6 Footnote with Daily Values (DV's)

Calibration graph of DNA fragment (standard marker),  $r_{w-1.222}$



$$BMI = \frac{\text{mass(kg)}}{(\text{height(m)})^2}$$

### Calorimetry:

Since volume does not change, a bomb calorimeter measures the heat evolved under constant volume,  $q_v$ .

$$dE = q_v = C * dT$$

Change in internal energy,  $dE$

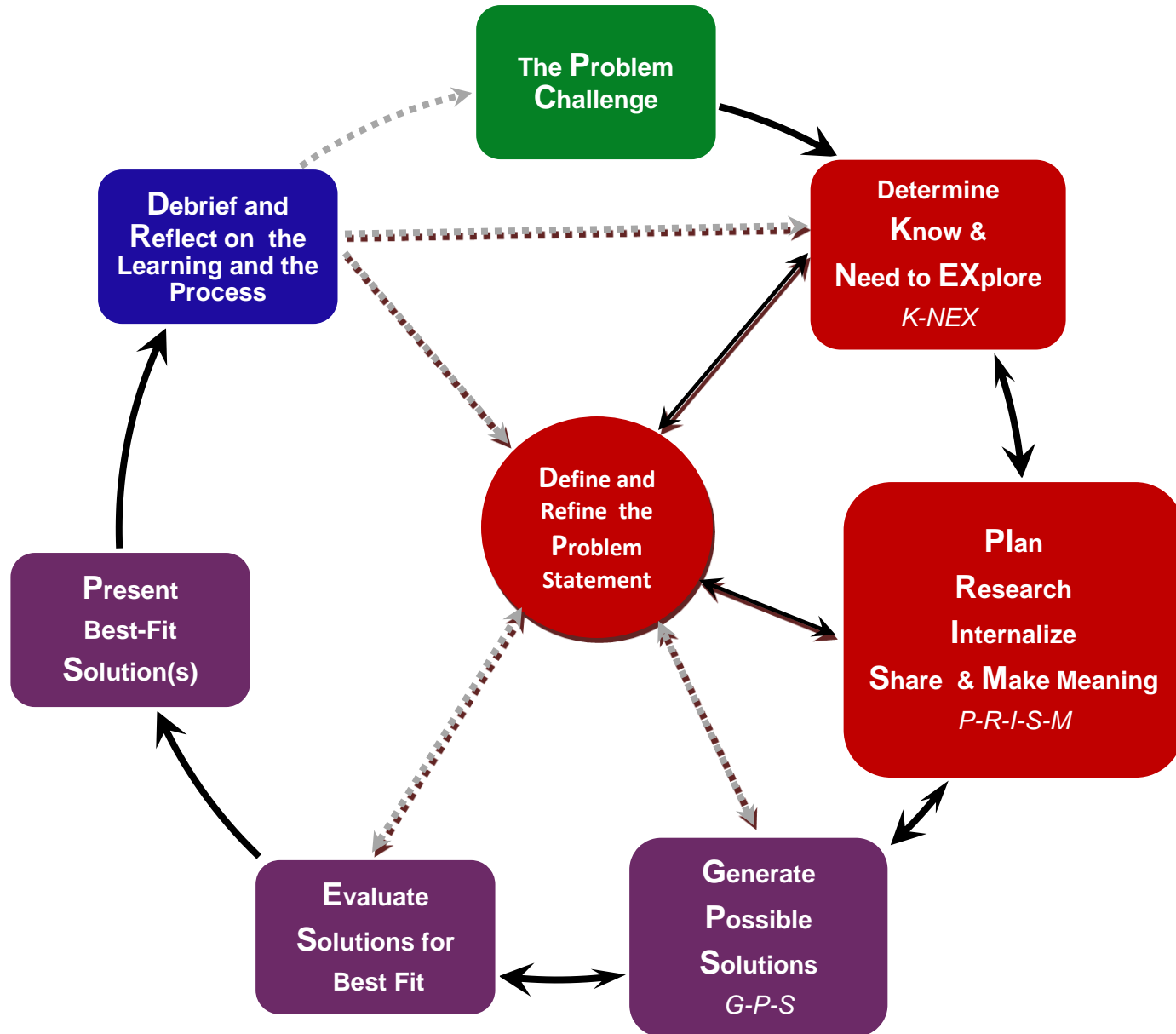
$$dE = q_v = s * m * dT$$

$s$ , specific heat;  $m$  mass

2003

**Ed**  
EDUCATE

# A Problem-Based Learning Cycle



# Generate Possible Solutions (*GPS*) and Evaluate Solutions for Best-Fit



Harvard's Project Zero *Visible Thinking* Routines used for **G-P-S** and **Evaluation for Best-Fit**

- “Options Diamond”
- “Options Explosion”
- “Does it Fit?”

For **Preparing Presentation**

- “Headlines Routine”



# Present Solutions to Experts

## Teachers Presented to Panels of Experts

- at end of Week 1 at

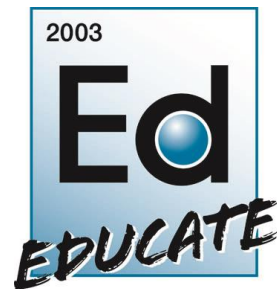
### Abbott Laboratories

Field trip included a plant tour and presentations by Abbott staff and scientists

- at end of Week 2 at

### Monsanto

Field trip tours of both **Donald Danforth Plant Science Center** and Monsanto, and presentations by scientists at both facilities



# Reflections and Debriefing the Learning and the Process

Reflection and debriefing occurs at the end of the process, but also throughout ...

- When?
- What?
- How?
- Why?

# Reflections and Debriefing the Learning and the Process

Examples of debriefing questions:

“I Used to Think... But Now I Think...”

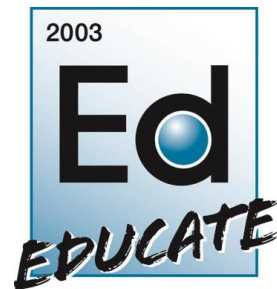
and many of the other Harvard's Project Zero *Visible Thinking* Routines, such as those previously discussed, and the simple reflection

“Something New I Learned Today”

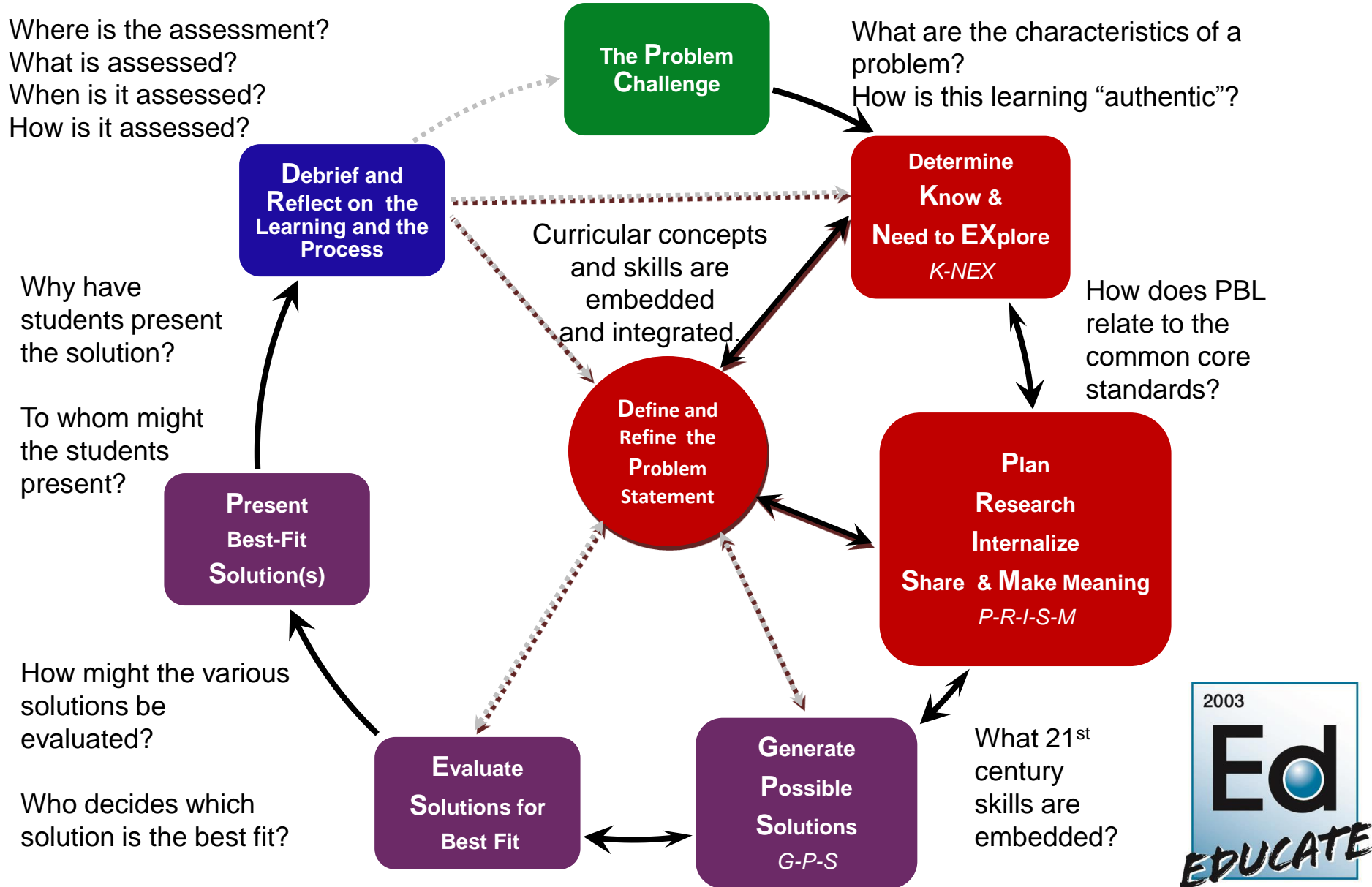
Conceptual knowledge questions on embedded content at various cognitive levels

Metacognitive and epistemic questions, such as

“How does this help you to better understand, to think about, and to solve the problem?”



# A Problem-Based Learning Cycle



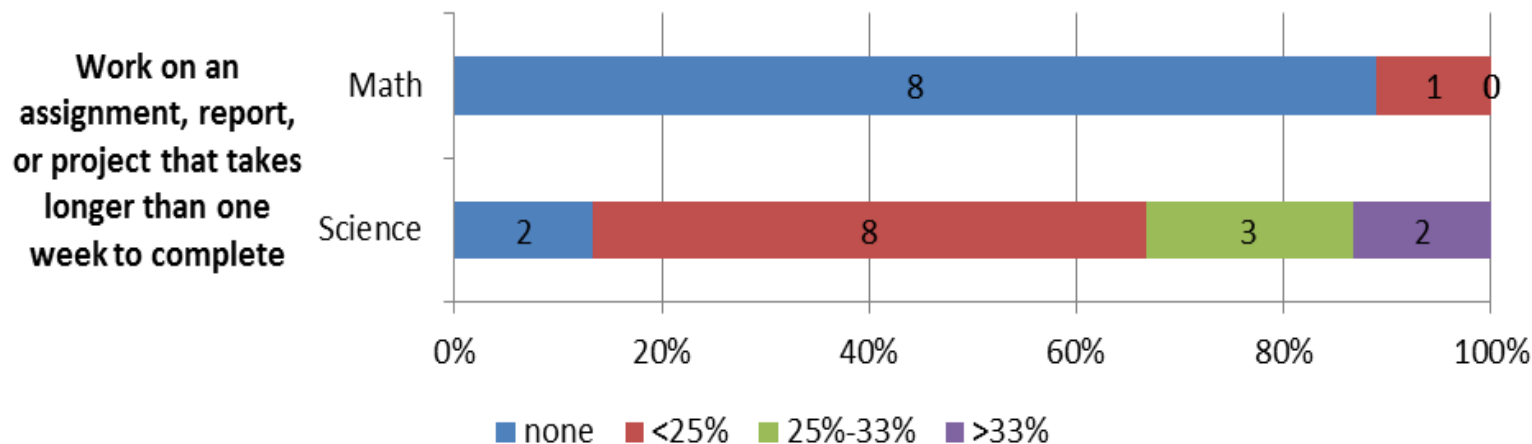


# Evaluation Approach

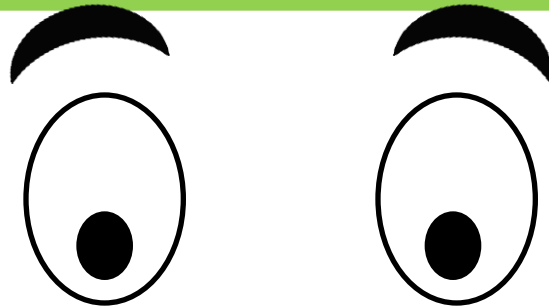
## Teacher Assessment

- Pre- and Post-test from NAEP/AAAS questions for math and science + content specific questions
- Daily surveys and reflection
- End of the summer overall
- Collections of artifacts of learning and thinking
- Project based Curriculum Survey (developed from SEC)

## Teacher Curriculum Survey Differences on Pretest

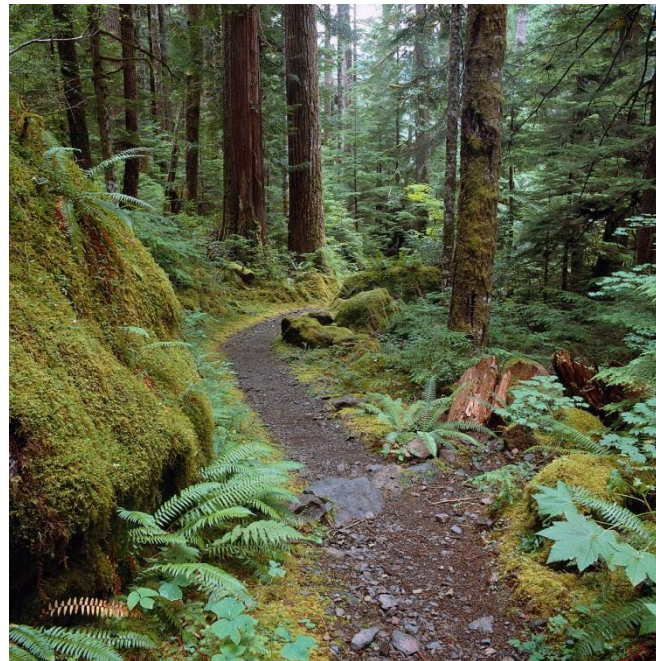


**Oh the Places We Could Go!**



# Preparing Learners for the PBL Journey

How might we plan for and prepare students for authentic, problem-based learning?



# How 'Bout Using Thinking Routines?

Such as *Think, Puzzle, Explore*

1. What do you **think** you know about this topic?
2. What questions or **puzzles** do you have?
3. How can you **explore** this topic?



# What did our mathematics teachers do with their students?

## **Kate Weber's** and **Shelly Wiegel's Algebra Classes**

addressed the obesity problem during the school day -- they factored in food availability and personal activity.\*

**Rebecca Canady's Math Prep (SpEd) Classes** investigated the problem of teenage obesity as what WHS, as a high school, can do to help students make better decisions. Rebecca collaborated with **Joe Wolinski** who also implemented an Obesity PBL with his **Health/P.E. Classes.**

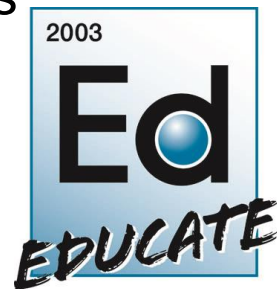
## **Mariola Sobol's Geometry Classes**

addressed the obesity problem at school--investigating the geometry of cafeteria trays and determining portion size and nutritional values.\*\*

Mariola's students presented tray analysis and portion findings to **Shannon Chamber's Biology Classes**—freshmen biology students then determined and analyzed the nutritional value of foods (integrated with macronutrients unit) and recommended changes at school and at home.

**See:** \*Classroom unit handouts

\*\*PBL Unit write up.



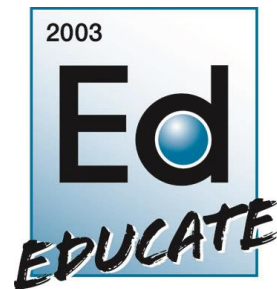
# What did our mathematics teachers say about the experience?

*Throughout this process I learned about letting go of control. No matter how much I structured each lesson I needed to realize that the students had to go through the process of exploration, problem solving, and working together on their own. Once I let go of the control, I realized that my students were capable of so much more than I had expected. They worked together cooperatively and stepped up when it came time to perform. They were creative, diligent, and enthusiastic. What surprised me the most, was that the students who normally feared presenting and talking in class, were the ones who stepped up the most. –Rebecca Canady, Math Prep (SpEd) Teacher*

# What did our **mathematics** teachers say about the experience?

**Kate Weber, Algebra Teacher,** and **Mariola Sobol, Geometry Teacher,**  
and their students speak for themselves

See iBIO Institute EDUCATE Center video





# Support/Reaction from Administration

## RE: Obesity PBL Projects

I just wanted to let you know we have had a wonderful PBL week! On Tuesday, we had a team of teachers with four rotating sessions and hundreds of students learning about Obesity and sharing their research on the subject. Math students presented on portion sizes and calculating BMI, while biology students presented on everything from the effects of obesity on the brain to obesity and nursing mothers. Today, I was part of a panel of pregnant women observing students in Human Growth who researched and presented possible solutions to improving nutrition, physical activity, and overall health during pregnancy. The teacher even framed her PBL using our QUEST skills language. Thanks, again, for including us in this grant project.

-Laz Lopez

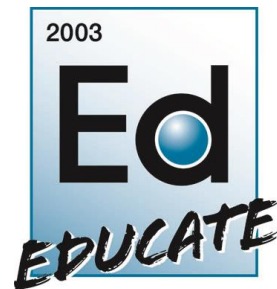
WHEELING HIGH SCHOOL

A Comprehensive High School with a STEM Focus



# Results

- Teachers showed consistently statistically significant gains in both science and mathematics content knowledge as measured by NAEP and AAAS items:
  - 2011 gains: 6 percentage points in mathematics and 13 percentage points in science;*
  - 2012 gains: 12 percentage points in mathematics and 4 percentage points in science.*
- Teachers showed significant gains after just one year on the Curriculum Survey in many areas. ESPECIALLY the Mathematics teachers!
- Student content gains in both are greater this year than last year (as high as 24% increase, and almost all gains are significant).
- All participating teachers implemented a problem-based unit by end of last school year and are planning or have implemented a new PBL unit for this school year
- Virtually all teachers have networked with academic or industry partners and community in implementing their PBL units in their classroom.
- Increased use of technology in teaching and learning
- Focused on aligning PBL to CCSS, NGSS, and 21<sup>st</sup> C skills
- Increased teacher and student 21<sup>st</sup> century skills
- All participated in at least one lesson study using the **L.A.S.T.**  
**(Looking at Student Thinking) Protocol** and in smaller professional learning communities (& webinars)



# Results

External evaluator comment on results of survey of enacted curriculum at end of year one of TalentSparks3

*“The findings are significant and particularly notable. This many changes are not normally observed among teachers over only one year of involvement. Changes such as these usually take 2 – 3 years to take effect.”*

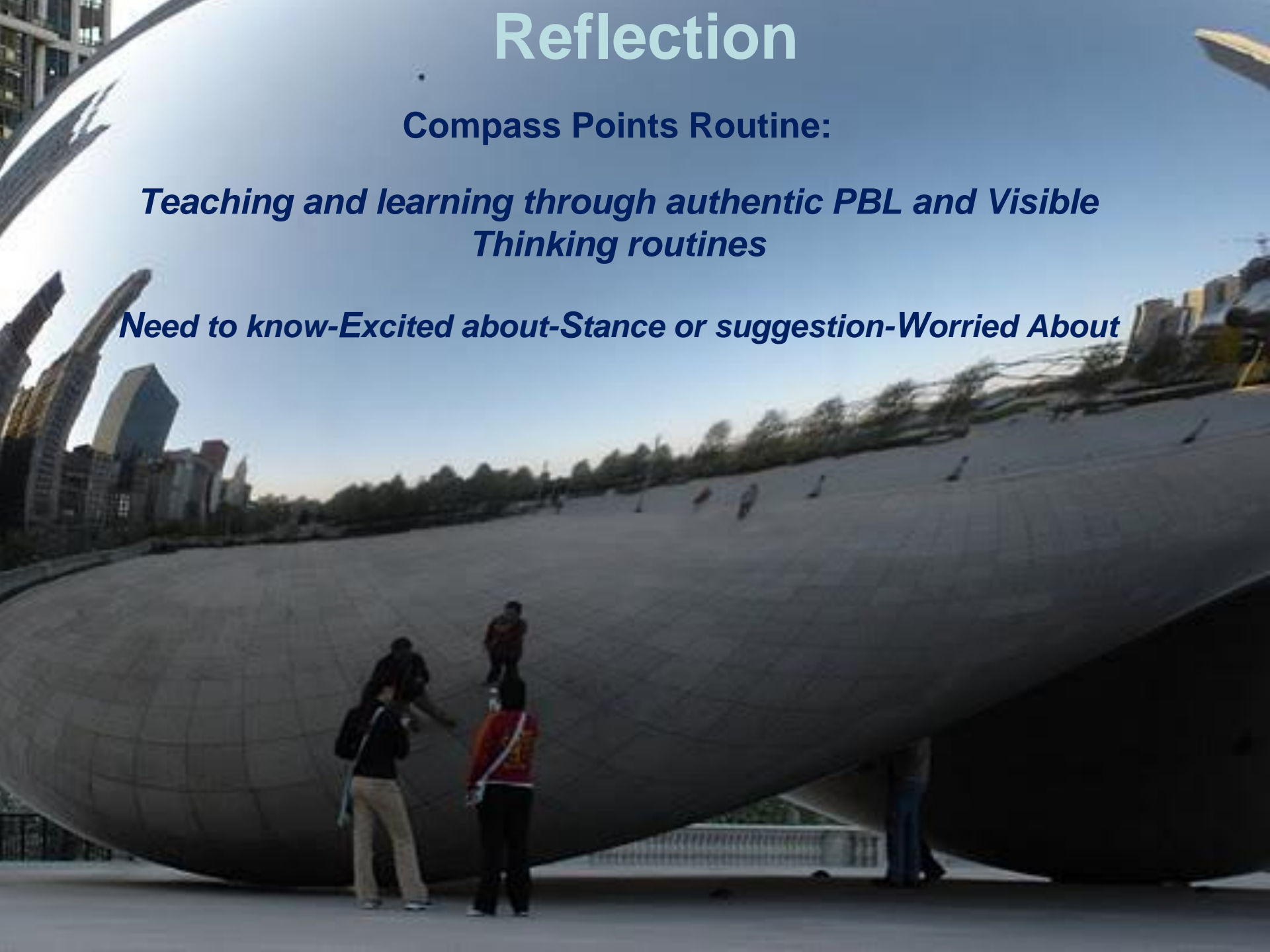
Matt Feldmann, Goshen Education, Inc.

# Reflection

**Compass Points Routine:**

***Teaching and learning through authentic PBL and Visible Thinking routines***

***Need to know-Excited about-Stance or suggestion-Worried About***





## Using 21<sup>st</sup> Century Skills to Solve 21<sup>st</sup> Century Problems!

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