



ACES Research Project:

Environmental factors which influence student achievement



FANNING HOWEY

creating places to *learn*

Spring 2013 CEFPI Chicagoland Chapter Seminar  
OPTIMIZING THE LEARNING ENVIRONMENT  
Elmhurst College  
Elmhurst, Illinois

## Connecting Students, Teachers, and the Environment



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Questions related to specific materials, methods, and services will be addressed at the conclusion of each presentation.

## Learning Objectives

### **Environmental Factors that Influence Student Achievement**

At the end of this program, participants will be able to:

- 1. Understand the Four Energy Zones of schools.*
- 2. Understand how students are effected by the built environment.*
- 3. Understand the importance of technology integration.*
- 4. Understand the importance of educational programming.*
- 5. Understand the importance of community use.*
- 6. Learn how the building can move students into the Passion Zone.*

## Do facilities matter?



“One friend, one person who is truly understanding, who takes the trouble to listen to us as we consider our problems, can change our whole outlook on the work.”

~ Elton Mayo

## The Hawthorne Effect



- Part of the variation in the illumination experiments can be accounted for by other factors such as the weekly schedule or seasonal temperature.
- Elton Mayo's original conclusions were overstated.

~ Steven Levitt  
John A. List

(2011). "Was There Really a Hawthorne Effect at the Hawthorne Plant? An Analysis of the Original Illumination Experiments". *American Economic Journal: Applied Economics* 3 (1): 224-238.

## The Hawthorne Effect



- Allowing for a variety of other factors, the author assesses whether experimental changes, variously defined, had a common effect that could be regarded as a pure result of the experimentation.
- The main conclusion is that these data show slender or no evidence of a Hawthorne effect.

~ Steven R. G. Jones  
(1992)

"Was there a Hawthorne effect?"  
*American Journal of Sociology*

## The Hawthorne Effect



"a glorified anecdote"

"Once you have got the anecdote, you can throw away the data."

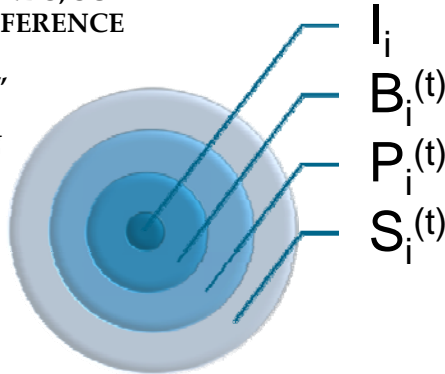
~ Dr. Richard Nisbett

University of Michigan  
Kolata, G. (1998)  
*Scientific Myths That Are Too Good to Die*. New York  
Times, December 6

## Connecting Students, Teachers, and the Environment

"AS OUR CIRCLE OF KNOWLEDGE EXPANDS, SO DOES THE CIRCUMFERENCE OF DARKNESS SURROUNDING IT."

~ ALBERT EINSTEIN



Eric Hanushek  
*The Production of Education, Teacher Quality and Efficiency*  
February 1970

The vector of educational outputs is a function of the following factors over time.

$A_i = f(I_i, B_i^{(t)}, P_i^{(t)}, S_i^{(t)})$   
where:

A = Educational outputs of the  $i^{\text{th}}$  student at time  $t$ .

I = Innate Abilities

B = Family Inputs

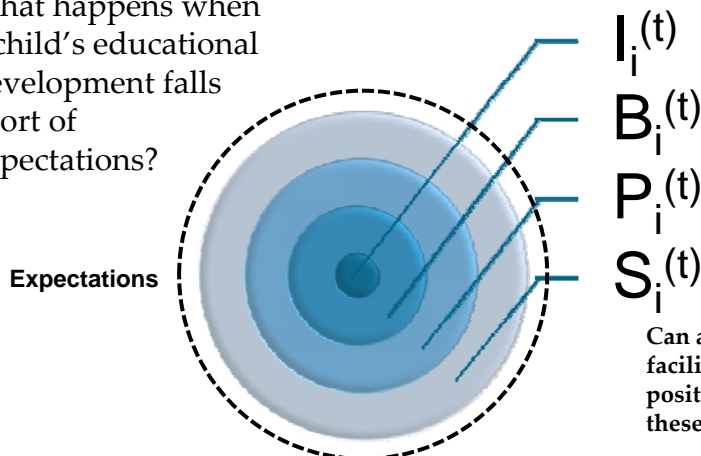
P = Peer Influences

S = School Inputs

EQUATION OF THE EDUCATIONAL PROCESS  
BY: ERIC HANUSHEK (FEB 1970)

## Connecting Students, Teachers, and the Environment

What happens when a child's educational development falls short of expectations?



Can a school facility have a positive impact on these variables?

EQUATION OF THE EDUCATIONAL PROCESS  
BY: ERIC HANUSHEK (FEB 1970)

## 1. Introduction

Two graduate students at Indiana University South Bend have created this survey as part of a statistical research project. The goal is to collect data through direct surveys of principals to evaluate whether there is a statistical link between the perceived quality of an educational environment and academic achievement. This project is required for partial completion of the requirements for A503 Statistical Applications Spring 2012 at Indiana University South Bend. For the purpose of this class, responses are being solicited from school principals in particular.

The presentation of the data collected will keep the names of individual schools and respondents in confidence.

Thank you for your assistance with this project. If you have any comments or questions please direct them to Greg Monberg at [gmonberg@iusb.edu](mailto:gmonberg@iusb.edu).

Sincerely,

Peter Riordan  
Greg Monberg

MBA Students  
School of Business and Economics  
Indiana University South Bend  
South Bend, Indiana

# Principals' Assessment of Schools Survey

## 2. Teaching Space

The purpose of this page is to gather information on who is responding to this survey.

**\*1. Please provide the following demographic information. Please provide the name of the school you are assessing, the school district, the location and your role; such as principal, administrator, teacher, staff member, student, parent, or community member.**

School Name	<input type="text"/>
School District Name	<input type="text"/>
City	<input type="text"/>
State	<input type="text"/>
Your Role	<input type="text"/>

## 3. Educational Environment

The following questions gather information about the environment of your teaching space.

**\*1. Please provide your assessment of the school relative to the following statements. Answer from 1 strongly disagree to 5 strongly agree. At the end, please provide any additional information that will help us understand your particular school facility:**

	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
Students are able to clearly hear what is presented in the classrooms.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The interior finishes including flooring, partition covering, and ceilings are in excellent condition.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Student chairs and desks are comfortable, mobile, and well maintained.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are no disruptive noises outside the classrooms from traffic, noise or adjacent rooms.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are no disruptive noises inside classrooms from mechanical equipment or other systems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lighting controls are adequate for adjusting classroom brightness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The air in the classrooms seems fresh and comfortable, neither stale nor too humid.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students can clearly see the instructional material being presented.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The classrooms are free from glare due to lighting or windows.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The classroom windows can open and close.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Each classroom has windows to the outside with views.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are no unpleasant odors in the classrooms.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is no visible sign of water damage in the classrooms such as stained ceiling tiles or peeling paint.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There are temperature controls in the classrooms that work.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The classrooms are rarely too hot or too cold.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 2. Additional Information:

**15 Questions**  
**Possible Points 15-75**  
**Mean Score 53.93**  
**Range 19-69**



# Principals' Assessment of Schools Survey

## 4. Integration of Technology

The following questions gather information about the integration and availability of technology in your teaching space.

\*1. Please provide your assessment of the integration and availability of technology in your teaching space relative to the following statements. Answer from 1 strongly disagree to 5 strongly agree. At the end, please provide any additional information that will help us to understand your particular concerns:

	1. Strongly Disagree	2. Disagree	3. Neutral	4. Agree	5. Strongly Agree
Every classroom has a sound reinforcement system with microphones.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wireless connectivity is available throughout the entire building.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every student has a personal computer.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every classroom has a large format video display, either a projector or LCD/Plasma TV.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adequate power and data ports are provided in each classroom.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every student has access to a computer and the internet in each classroom.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A dedicated camera is provided in each classroom.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interactive touch sensitive technology is provided in every classroom.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distance learning technology is provided in the school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every student has access to a mobile digital hand-held device.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every classroom has technology to support student and teacher collaboration.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every teacher has a personal computer and access to the district network.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interactive student response systems (or "clickers") are available in each classroom.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every classroom has a communications system connected to the main office.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Every student has a personal mobile digital hand-held device.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Additional Information:

**15 Questions**  
Possible Points 15-75  
Mean Score 41.00  
Range 26-63

## 5. Educational Program Needs

The following questions gather information about the educational program needs in your building.

\*1. Please provide your assessment of the educational program needs in your school relative to the following statements. Answer from 1 strongly disagree to 5 strongly agree. At the end, please provide any additional information that will help us to understand your particular concerns:

	1. Strongly Disagree	2. Disagree	3. Neutral	4. Agree	5. Strongly Agree
Paper space is provided for individual student storage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers often rearrange their classrooms to support various student activities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adequate space is provided for all required educational programs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school building is well equipped to support team teaching.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well equipped to teach Special Needs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Student work can be displayed prominently throughout the school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well equipped to teach the Language Arts curriculum.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well equipped to support project based instruction.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school has space to support collaboration between teachers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is adequate space to rearrange each room to support different learning styles.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well equipped to teach Science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school has adequate space for instructional storage.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well equipped to teach Physical Education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well equipped to teach Art and Music.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well equipped to teach Math.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well equipped to teach Social Studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The learning spaces are flexible in supporting various sized groups of students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Additional Information:

**17 Questions**  
Possible Points 17-85  
Mean Score 62.63  
Range 17-84

# Principals' Assessment of Schools Survey

## 6. Community Needs

The following questions gather information about the community needs in your building.

\*1. Please provide your assessment of the educational program needs in your school relative to the following statements. Answer from 1 strongly disagree to 5 strongly agree. At the end, please provide any additional information that will help us to understand your particular concerns:

	1. Strongly Disagree	2. Disagree	3. Neutral	4. Agree	5. Strongly Agree
The cafeteria is designed to support community use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The community takes pride in this school building.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well situated to provide security for after school programs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This school building is a landmark in the community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a parent room or a place for PTO and community meetings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The media center is designed to support community use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
This school serves as a social center for the neighborhood.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The gymnasium is designed to support community use.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The school is well equipped to support community programs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The playgrounds and arena fields are accessible to the community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Additional Information:

**10 Questions**  
Possible Points 10-50  
Mean Score 35.87  
Range 24-47

## 7. School Morale Issues

The following questions gather information about the morale in your school.

\*1. Please provide your assessment of the morale in your school relative to the following statements. Answer from 1 strongly disagree to 5 strongly agree. At the end, please provide any additional information that will help us to understand your particular concerns:

	1. Strongly Disagree	2. Disagree	3. Neutral	4. Agree	5. Strongly Agree
Teachers value academic achievement.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The morale of teachers in this school is high.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drug abuse related issues are not major problems at this school community.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers take pride in this school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students value academic achievement.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vandalism and/or graffiti are not problems at this school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students stay classes timely.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students are respectful and courteous.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Intimidation and bullying are rarely problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Student absenteeism is low.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students enjoy being in school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students do their best to learn as much as possible.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Discipline of classes by students is minimal.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students work with enthusiasm.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students take pride in this school.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers work with enthusiasm.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students being encouraged to achieve their full potential.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teacher attendance is low.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relationships between students, parents and teachers are excellent.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students have respect for teachers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Instruction is individualized to meet each student's needs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Parents are actively involved.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Staff is open to change and new ideas.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Students value the education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Additional Information:

**24 Questions**  
Possible Points 24-120  
Mean Score 97.1  
Range 77-120

# What were the results?

Did standardized test scores go up or down relative to the principals' assessment of the school facility for:

- Physical Conditions
- Technology Integration
- Educational Program Fit
- Community Use

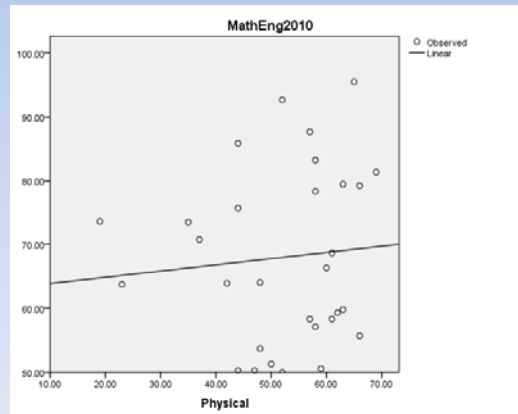
## Physical Conditions – No Correlation

### Model Summary and Parameter Estimates

Dependent Variable: MathEng2010

Equation	Model Summary		Parameter Estimates			Constant	b1
	R Square	F	df1	df2	Sig.		
Linear	.008	.217	1	28	.645	62.885	.097

The independent variable is Physical.





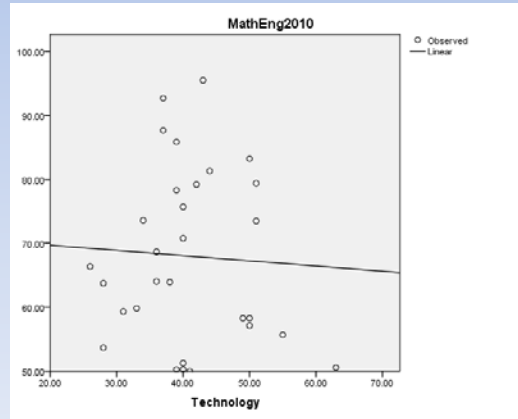
# Technology – No Correlation

## Model Summary and Parameter Estimates

Dependent Variable: MathEng2010

Equation	Model Summary		Parameter Estimates				
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.003	.071	1	28	.791	71.258	-.081

The independent variable is Technology.



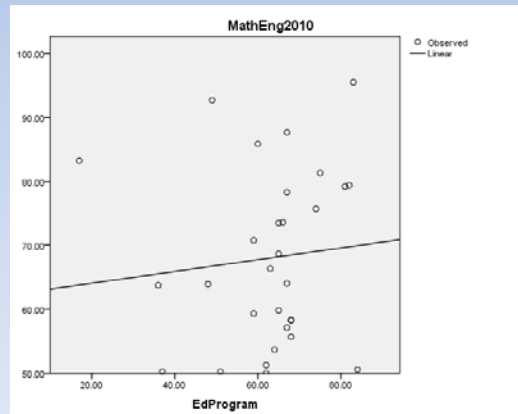
# Educational Prog Fit – No Correlation

## Model Summary and Parameter Estimates

Dependent Variable: MathEng2010

Equation	Model Summary		Parameter Estimates				
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.009	.268	1	28	.609	62.207	.091

The independent variable is EdProgram.



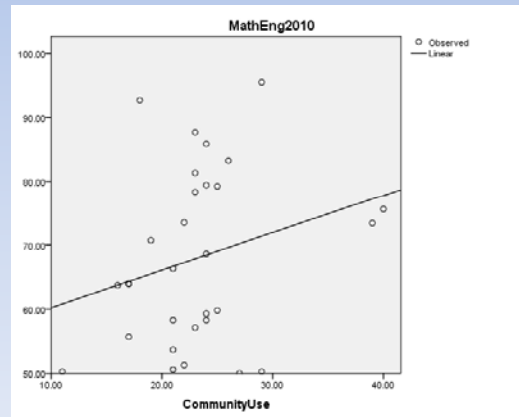
## Community Use – Weak Correlation

### Model Summary and Parameter Estimates

Dependent Variable: **MathEng2010**

Equation	Model Summary		Parameter Estimates				
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.065	1.941	1	28	.174	54.358	.586

The independent variable is **CommunityUse**.



## PREVIOUS RESEARCH

### Complexity Index – State of Indiana Public School Funding Formula

Socio-economic factors impacting test scores:

- Percentage of Students on Free Lunch
- Percentage of Families with children below the poverty level
- Percentage of Population over 25 without high school diploma
- Percentage of Single Parent Families
- Percentage of Students with limited English Proficiency

Center for Evaluation & Education Policy, Education Policy Brief  
 “What is the Complexity Index?”, Volume 5, Number 2, Winter 2007  
 Robert K. Toutkoushian and Robert S. Michael  
 Indiana University

## PREVIOUS RESEARCH

Complexity Index – State of Indiana Public School Funding Formula  
Socio-economic factors impacting test scores:

Toutkoushian and Michael recommended simplifying the complexity index to one variable only:

- Percent of Students on Free Lunch

Center for Evaluation & Education Policy, Education Policy Brief  
“What is the Complexity Index?”, Volume 5, Number 2, Winter 2007  
Robert K. Toutkoushian and Robert S. Michael  
Indiana University

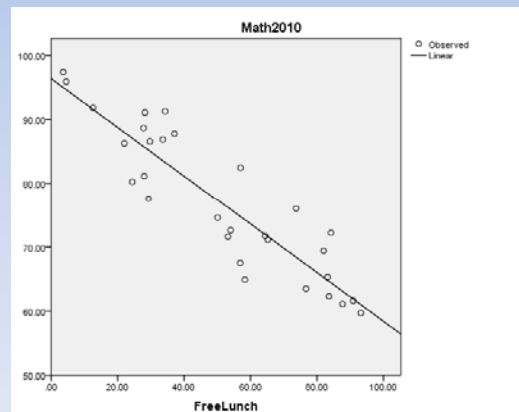
## Math Pass Rate – Indiana ISTEP+ 2010

### Model Summary and Parameter Estimates

Dependent Variable: **Math2010**

Equation	Model Summary		Parameter Estimates					
	R Square	F	df1	df2	Sig.	Constant	b1	
Linear	<b>.818</b>	125.871	1	28	<b>.000</b>	96.352	<b>-.379</b>	

The independent variable is **FreeLunch**.



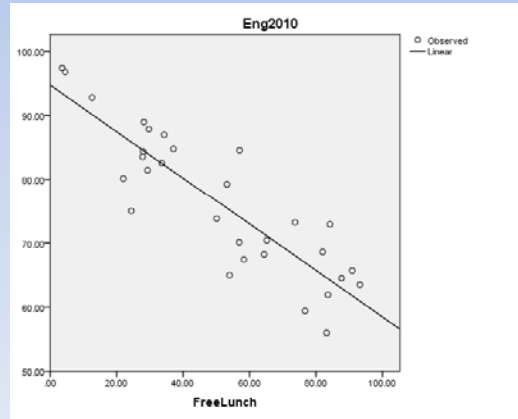
## English Pass Rate – Indiana ISTEP+ 2010

### Model Summary and Parameter Estimates

Dependent Variable: **Eng2010**

Equation	Model Summary		Parameter Estimates			Constant	b1
	R Square	F	df1	df2	Sig.		
Linear	<b>.766</b>	91.810	1	28	<b>.000</b>	94.734	<b>-.363</b>

The independent variable is **FreeLunch**.



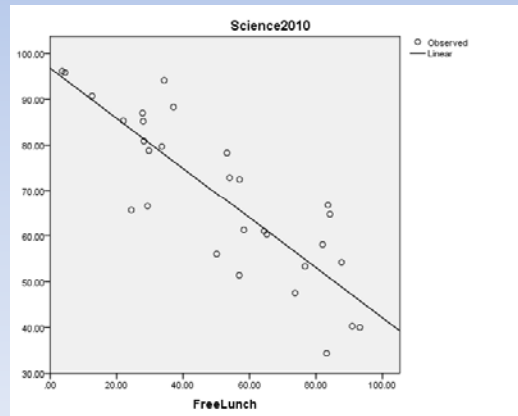
## Science Pass Rate – Indiana ISTEP+ 2010

### Model Summary and Parameter Estimates

Dependent Variable: **Science2010**

Equation	Model Summary		Parameter Estimates			Constant	b1
	R Square	F	df1	df2	Sig.		
Linear	<b>.717</b>	70.773	1	28	<b>.000</b>	96.749	<b>-.546</b>

The independent variable is **FreeLunch**.



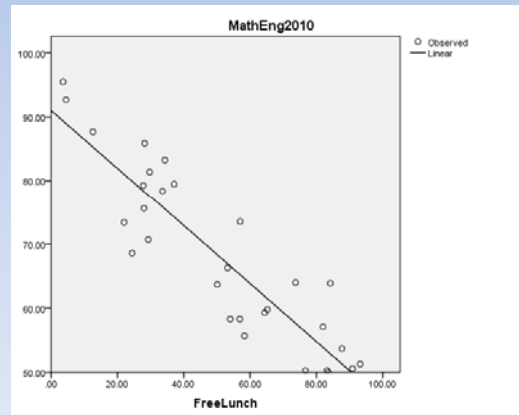
## Combined Pass Rate – Indiana ISTEP+ 2010

### Model Summary and Parameter Estimates

Dependent Variable: MathEng2010

Equation	Model Summary		Parameter Estimates			Constant	b1
	R Square	F	df1	df2	Sig.		
Linear	.813	121.358	1	28	.000	91.019	-.453

The independent variable is FreeLunch.



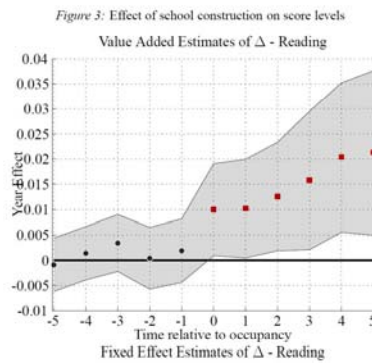
## Combined Pass Rate – Indiana ISTEP+ 2010

### Model Summary and Parameter Estimates

- **81.3%** of the variation in the Combined Pass Rate can be predicted by the variation in the percentage of free lunch students.
- **1%** higher percentage of free lunch students correlates to a reduction in the Combined Pass Rate of **.435** points.

**Schools with high poverty rates tend to do poorly on standardized tests.**

## PREVIOUS RESEARCH



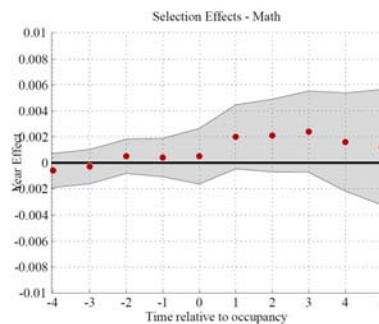
Institute for the Study of Labor

*The Effect of School Construction on Test Scores, School Enrollment, and Home Prices*, IZA DP No. 6106, November 2011,

**Christopher Neilson** *Yale University*,

**Seth Zimmerman** *Yale University and IZA*

## PREVIOUS RESEARCH



Institute for the Study of Labor

*The Effect of School Construction on Test Scores, School Enrollment, and Home Prices*, IZA DP No. 6106, November 2011,

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# PREVIOUS RESEARCH

Neilson and Zimmerman were “agnostic” as to why new school construction was related to improved test scores. However, they surveyed the principals and the most common reason cited by the principals was “improved school morale”.

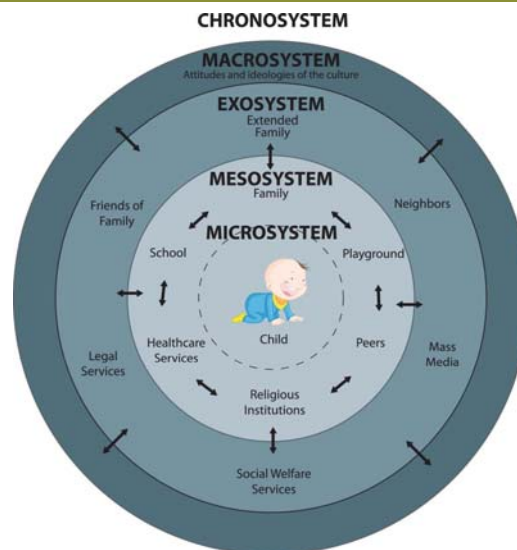
Institute for the Study of Labor

*The Effect of School Construction on Test Scores, School Enrollment, and Home Prices*, IZA DP No. 6106, November 2011,

**Christopher Neilson** Yale University,

**Seth Zimmerman** Yale University and IZA

# BIOECOLOGICAL SYSTEMS THEORY



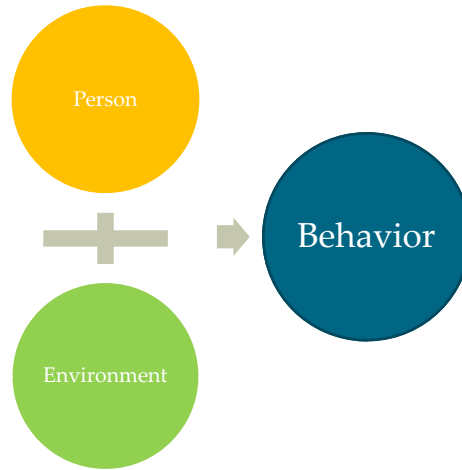
Urie Bronfenbrenner



## Energizing Learning through the Four Zones

$$B=f(PE)$$

~ KURT LEWIN (1935)



### The Four Energy Zones impacting Student Achievement

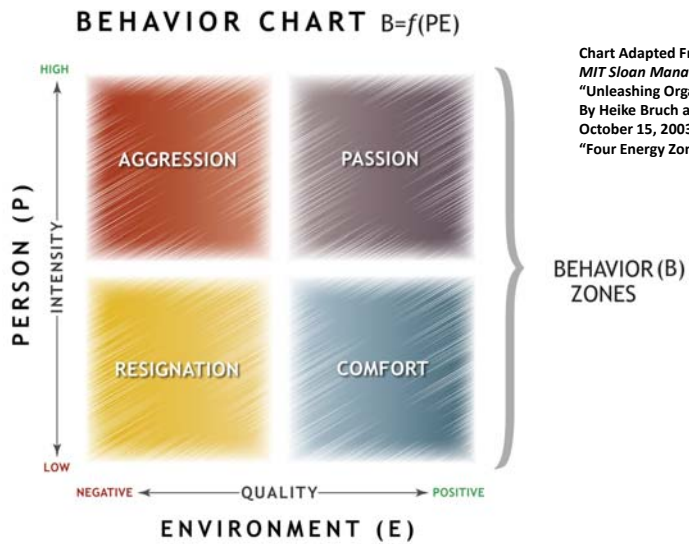


Chart Adapted From:  
*MIT Sloan Management Review*  
"Unleashing Organizational Energy"  
By Heike Bruch and Sumantra Ghoshal  
October 15, 2003  
"Four Energy Zones"

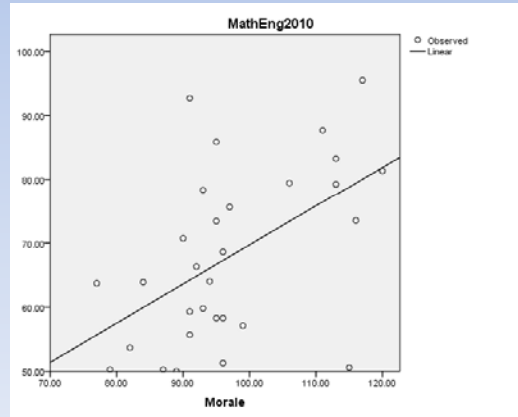
# Morale – Strong Correlation

## Model Summary and Parameter Estimates

Dependent Variable: MathEng2010

Equation	Model Summary	F	Parameter Estimates	df1	df2	Sig.	Constant	b1
Linear	.272	10.458		1	28	.003	8.703	.610

The independent variable is Morale.



## Resignation Zone - Rest



## Resignation Zone - Rest

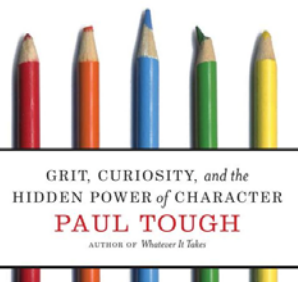


Design Principle:

Provide students rest through environmental conditions. Eliminate unnecessary physical and emotional stress through a quality environment.

## Resignation Zone - Rest

### *How* CHILDREN SUCCEED



- Cognitive Skills  
**Relatively Fixed**
- Non-Cognitive Skills  
**Can be Learned**
- Influence of Stress  
**Cortisol**

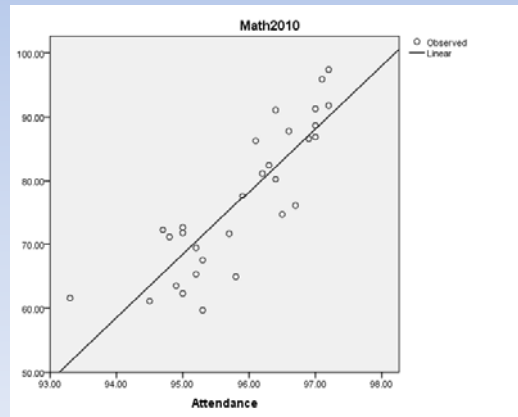
## Math Pass Rate – Indiana ISTEP+ 2010-11

### Model Summary and Parameter Estimates

Dependent Variable: **Math2010**

Equation	Model Summary		Parameter Estimates			Constant	b1
Linear	R Square	F	df1	df2	Sig.		
	.734	77.386	1	28	.000	-868.779	9.865

The independent variable is **Attendance**.



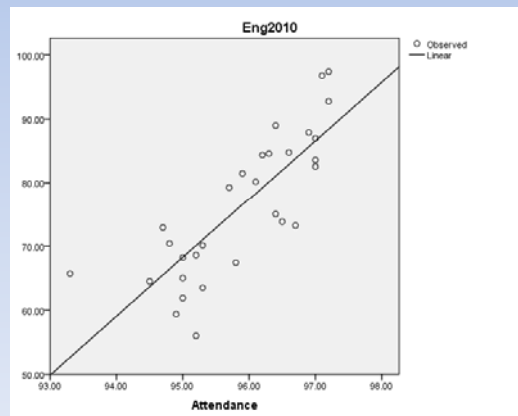
## English Pass Rate – Indiana ISTEP+ 2010-11

### Model Summary and Parameter Estimates

Dependent Variable: **Eng2010**

Equation	Model Summary		Parameter Estimates			Constant	b1
Linear	R Square	F	df1	df2	Sig.		
	.651	52.200	1	28	.000	-803.241	9.173

The independent variable is **Attendance**.



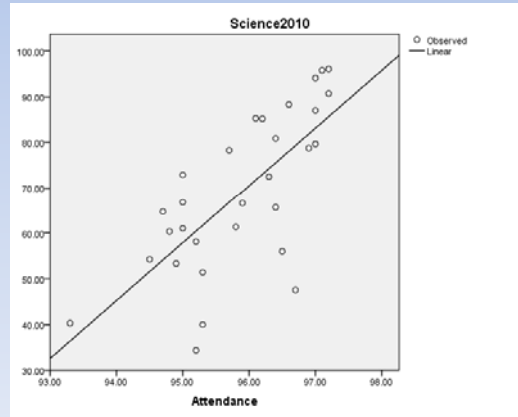
## Science Pass Rate – Indiana ISTEP+ 2010-11

### Model Summary and Parameter Estimates

Dependent Variable: **Science2010**

Equation	Model Summary		Parameter Estimates			Constant	b1
Linear	R Square	F	df1	df2	Sig.	-1142.392	12.634
	.508	28.962	1	28	.000		

The independent variable is **Attendance**.



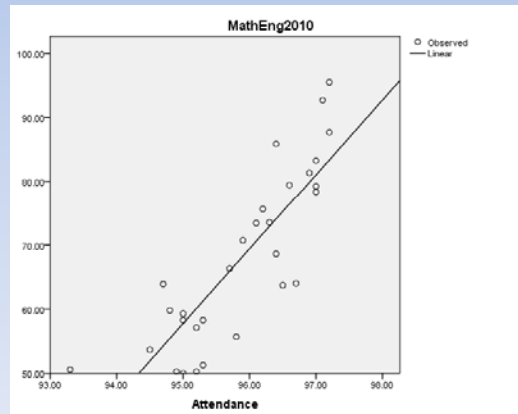
## Combined Pass Rate – Indiana ISTEP+ 2010

### Model Summary and Parameter Estimates

Dependent Variable: **MathEng2010**

Equation	Model Summary		Parameter Estimates			Constant	b1
Linear	R Square	F	df1	df2	Sig.	-1049.008	11.650
	.714	69.829	1	28	.000		

The independent variable is **Attendance**.



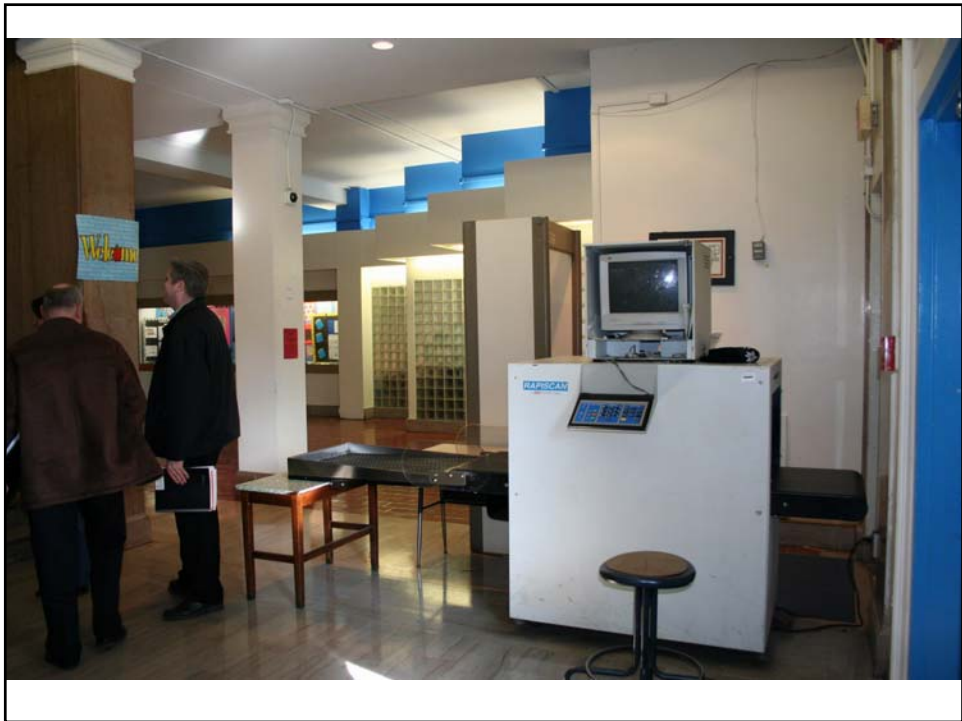
## Combined Pass Rate – Indiana ISTEP+ 2010

### Model Summary and Parameter Estimates

- **1%** increase in Attendance correlates to **11.6** point increase in a schools' combined pass rate.
- **1%** of an average school year is **1.8** days

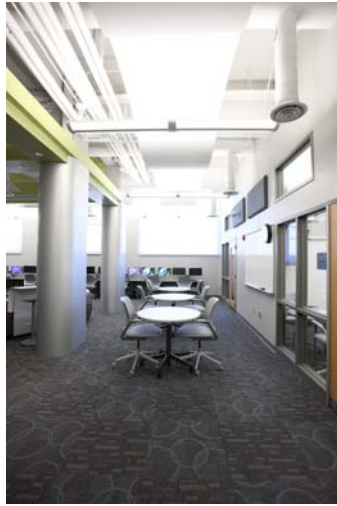
If the average student spends **1.8 days** more in class, there is a covariance in the schools' combined pass rate of **11.6 points**.







## Resignation Zone - Rest



Which design features have the largest impact on student performance?

- Thermal Comfort
- Indoor Air Quality
- Visual Comfort/  
Lighting
- Acoustics

Dr. Lance Roberts  
University of Manitoba  
CEFP 84<sup>th</sup> Annual Conference  
*Facility Conditions and Academic Achievement: Canadian Evidence*  
2007



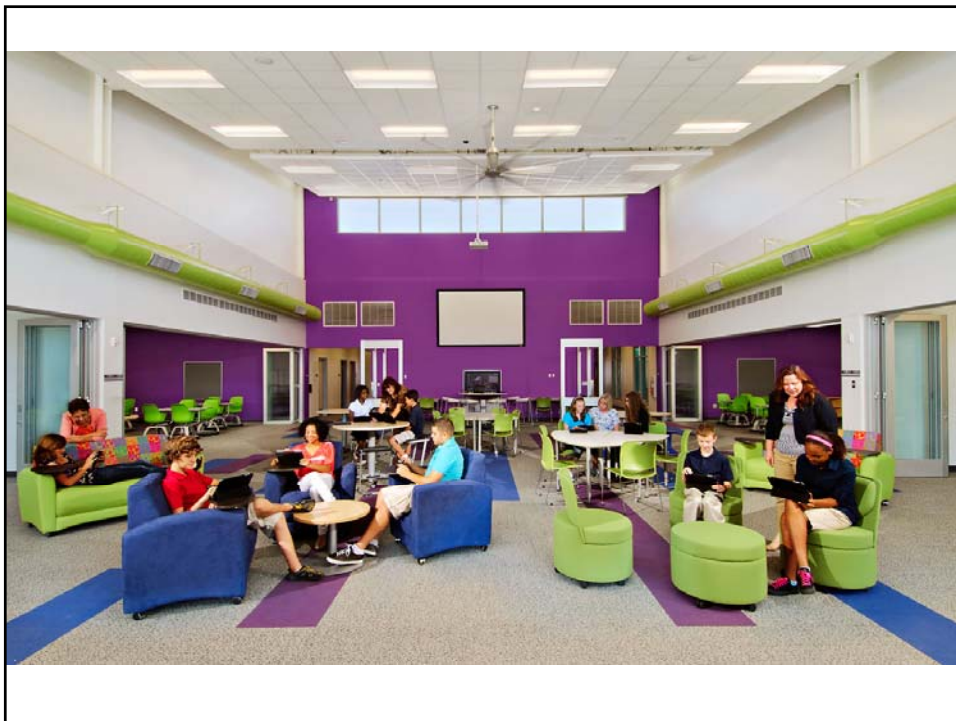


## Comfort Zone - Relevance



Design Principle:

Provide students relevance through choice. “Unfreeze” the classroom through mobility, flexibility, and technology. Support a variety of pedagogical approaches and learning styles.

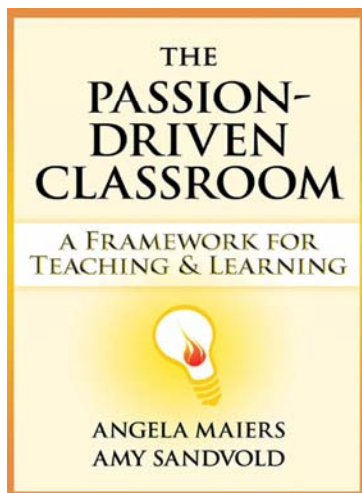








## Comfort Zone - Unfreeze



- Classroom “Club House”
- Allow students and teachers to create and recreate their space, day to day and hour to hour.

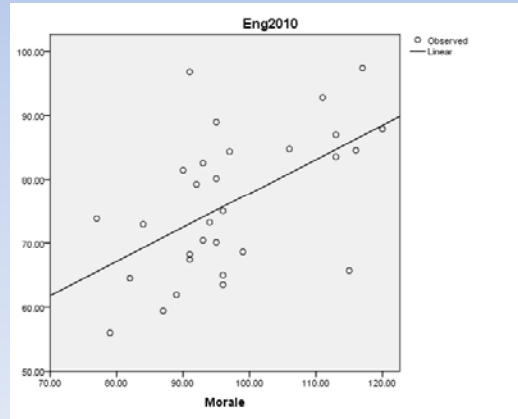
## Morale is related to English scores

### Model Summary and Parameter Estimates

Dependent Variable: **Eng2010**

Equation	Model Summary		Parameter Estimates			Constant	b1
	R Square	F	df1	df2	Sig.		
Linear	<b>.306</b>	12.370	1	28	<b>.002</b>	24.404	<b>.534</b>

The independent variable is **Morale**.



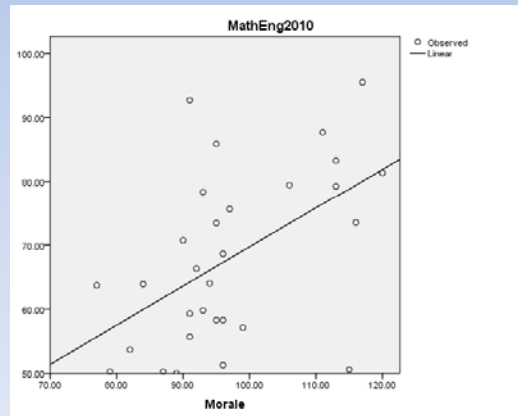
## Morale is related to Combined scores

### Model Summary and Parameter Estimates

Dependent Variable: **MathEng2010**

Equation	Model Summary		Parameter Estimates			Constant	b1
	R Square	F	df1	df2	Sig.		
Linear	<b>.272</b>	10.458	1	28	<b>.003</b>	8.703	<b>.610</b>

The independent variable is **Morale**.



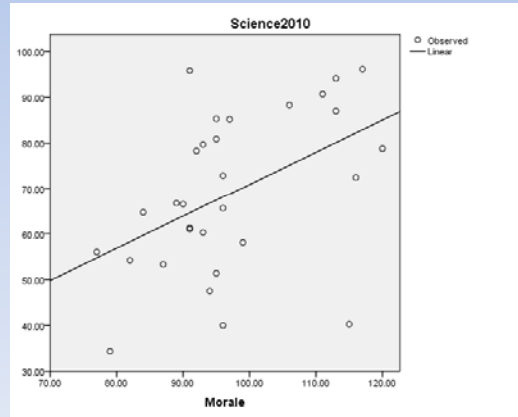
# Morale is related to Science scores

## Model Summary and Parameter Estimates

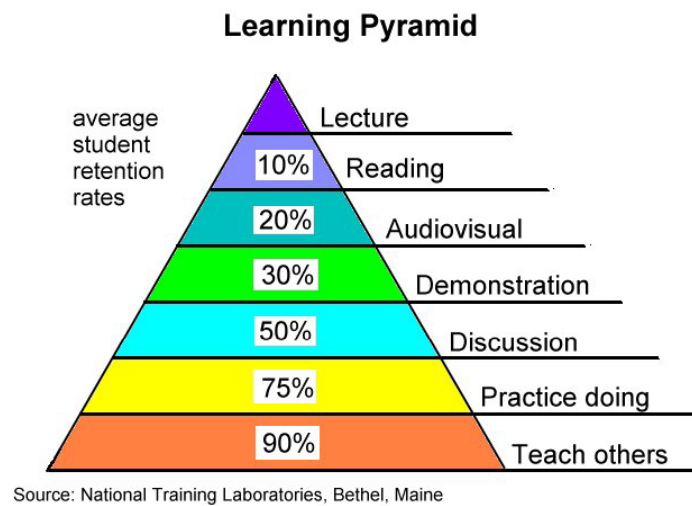
Dependent Variable: Science2010

Equation	Model Summary		Parameter Estimates			Constant	b1
Linear	R Square	F	df1	df2	Sig.	.469	.705
	.220	7.889	1	28	.009		

The independent variable is Morale.

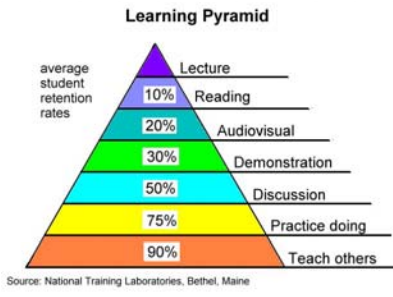


# Learning Pyramid





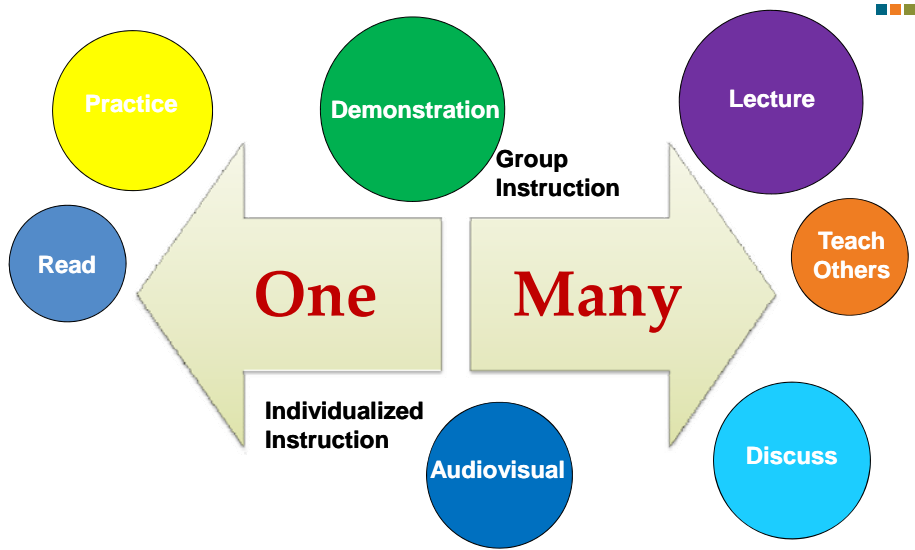
# Learning Pyramid



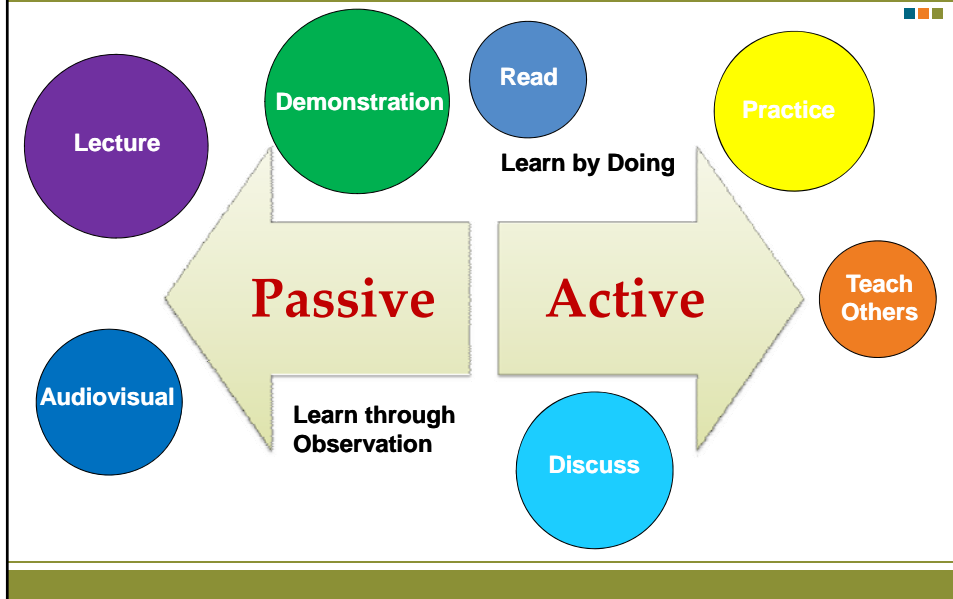
- Myth or Hoax?
- Seems intuitively plausible
- There is no published study documenting these retention rates
- “The research reviewed here demonstrates that use of each of the methods identified by the pyramid resulted in retention, with none being consistently superior to the others and all being effective in certain contexts.”

~Dr. James P. Lalley and R. Miller (2007)  
 “The learning pyramid: Does it point teachers in the right direction?”  
*Education and Information Technologies* v128, n1, 64-79

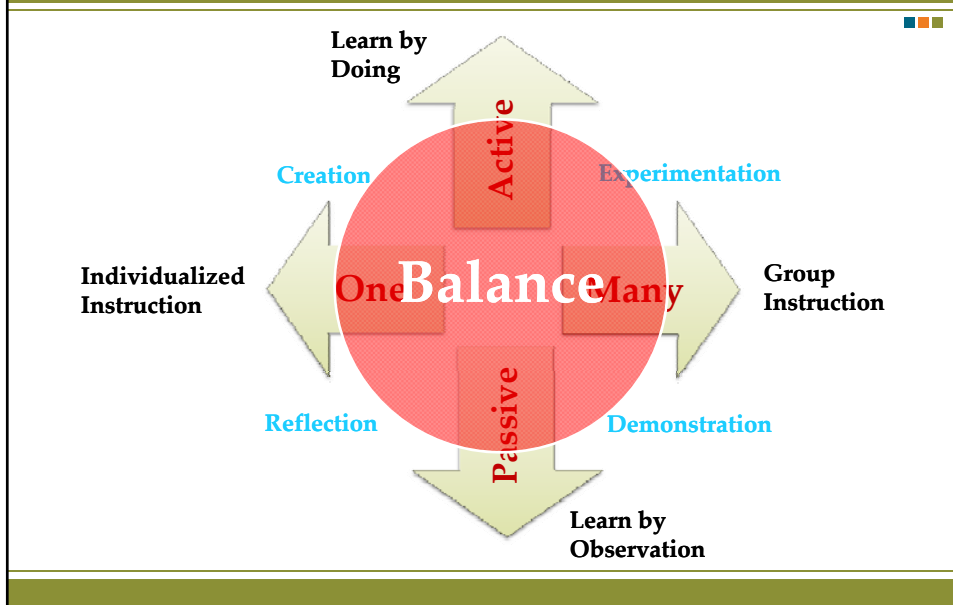
# The Horizontal Plane of Learning

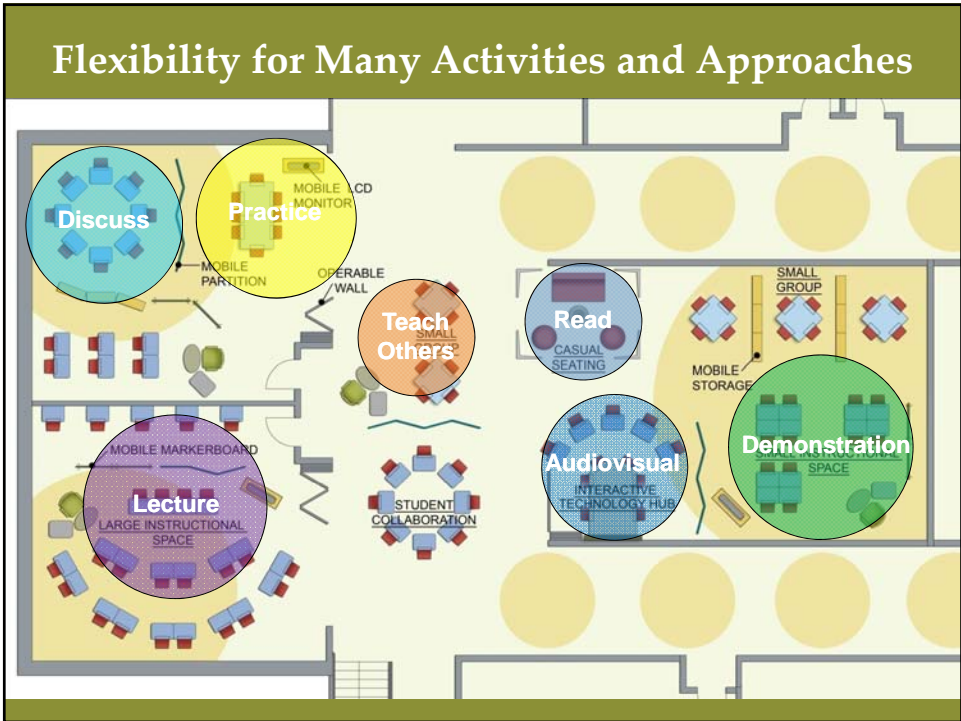
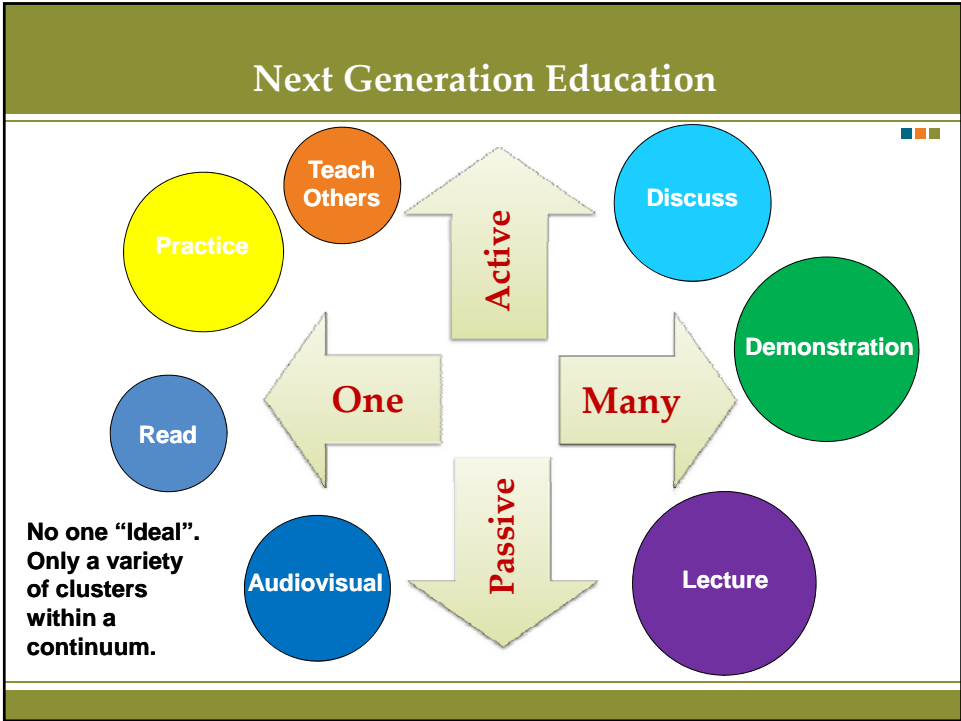


## The Horizontal Plane of Learning

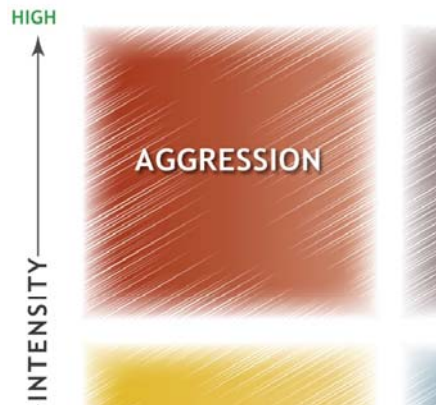


## Next Generation Education





## Aggression Zone - Rigor



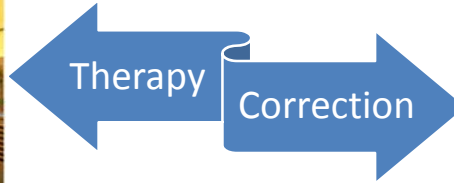
### Design Principle:

Provide students rigor through “positive feedback”. Create spaces that support formal and informal interactions. Allow students to share ideas, collaborate, and learn from each other as well as the instructor.



# PROVIDE FEEDBACK

## Therapeutic Facility



## Correctional Facility

### GRAY MATTER Designing for Calm

By ROGER S. ULRICH  
Published January 11, 2013

IT should come as no surprise that violence in **mental health facilities** causes psychological and often physical harm to health care workers and patients. What's shocking is how prevalent it is.



Photo: Wikimedia Commons, Stoker

Globally, a third of all patients admitted for psychiatric care are involved in violent incidents, according to a [2011 analysis](#) by researchers at King's College in London. In Sweden, where I teach, it's estimated that more than half of psychiatric care staff members are exposed to physical violence each year, an experience mirrored in many other countries.

Efforts to reduce violence in psychiatric hospitals have focused on identifying potentially aggressive patients through clinical histories and improving staff training and care procedures. But these approaches, while worthy, are clearly not enough. While definitive numbers are hard to come by, the incidence of violence in care facilities appears to be going up.

Research suggests, however, that there's an effective solution that has largely been overlooked: designing hospital spaces that can reduce human aggression — to calm emotionally troubled patients through architecture.

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SAVE

E-MAIL

SHARE

PRINT

REPRINTS

**STOKER**  
COMING SOON

## Aggression Zone - Rigor

### Design for Calm



Security and Safety does not mean architecture that mimics a prison setting.

Design for mental health and reduced stress.

Ostra Psychiatry Hospital  
The Garden, The Heart, The Residential Group







### Rest Relevance Rigor Relationships



### Resignation Comfort Aggression Passion



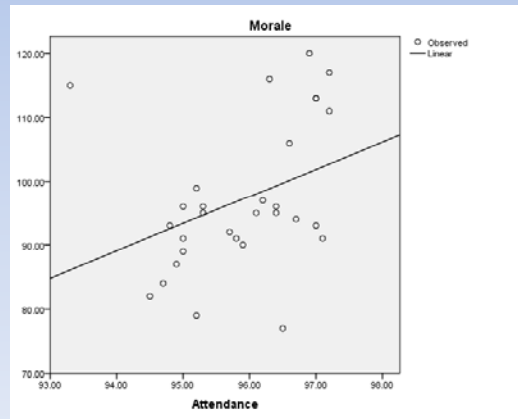
## Attendance is related to Morale

### Model Summary and Parameter Estimates

Dependent Variable: **Morale**

Equation	Model Summary		Parameter Estimates				
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.131	4.238	1	28	.049	-312.671	4.274

The independent variable is **Attendance**.



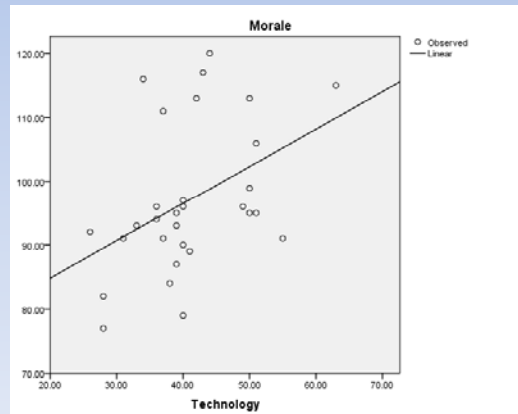
## Technology is related to Morale

### Model Summary and Parameter Estimates

Dependent Variable: **Morale**

Equation	Model Summary		Parameter Estimates				
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.181	6.188	1	28	.019	73.157	.584

The independent variable is **Technology**.



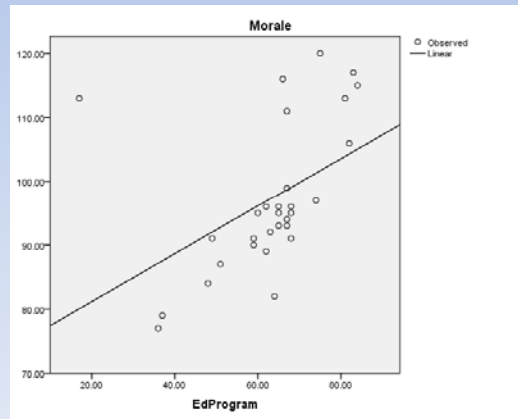
## Ed Program is related to Morale

### Model Summary and Parameter Estimates

Dependent Variable: **Morale**

Equation	Model Summary		Parameter Estimates			Constant	b1
	R Square	F	df1	df2	Sig.		
Linear	.216	7.721	1	28	.010	73.693	.374

The independent variable is **EdProgram**.



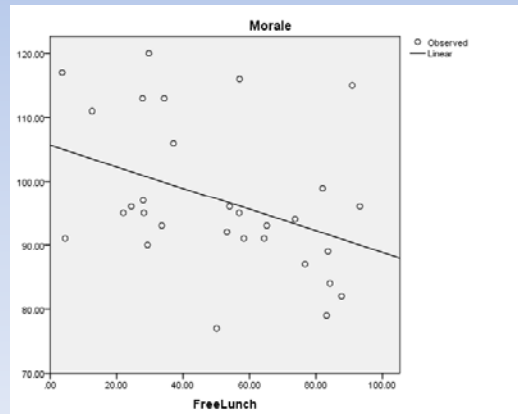
## Free Lunch is related to Morale

### Model Summary and Parameter Estimates

Dependent Variable: **Morale**

Equation	Model Summary		Parameter Estimates			Constant	b1
	R Square	F	df1	df2	Sig.		
Linear	.154	5.110	1	28	.032	105.700	-.169

The independent variable is **FreeLunch**.



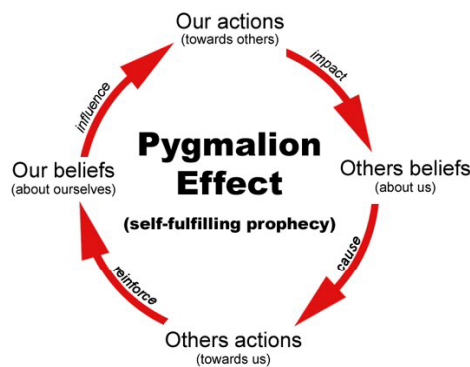
## Passion Zone - Relationships



### Design Principle:

Provide students the opportunity to build relationships. Allow students and teachers to directly engage with the subject. Eliminate filters between the student and the object.

## "Pygmalion Effect"



"Harvard Test of Inflected Acquisition"

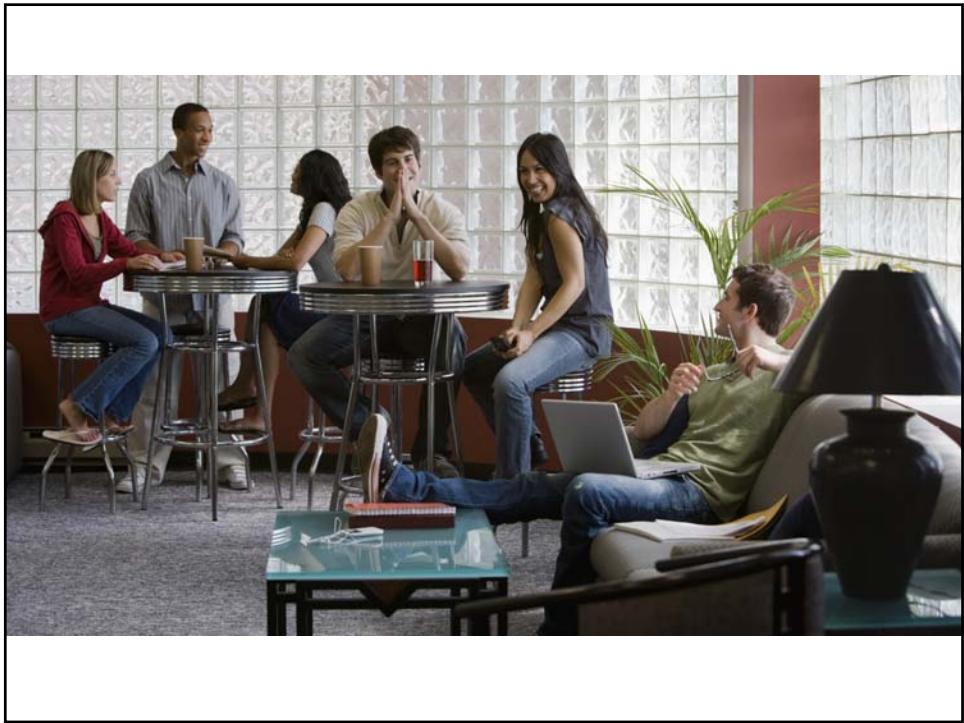
"designed to predict academic blooming"

Experimental group showed a 12.22 point gain versus an 8.42 gain for the control group

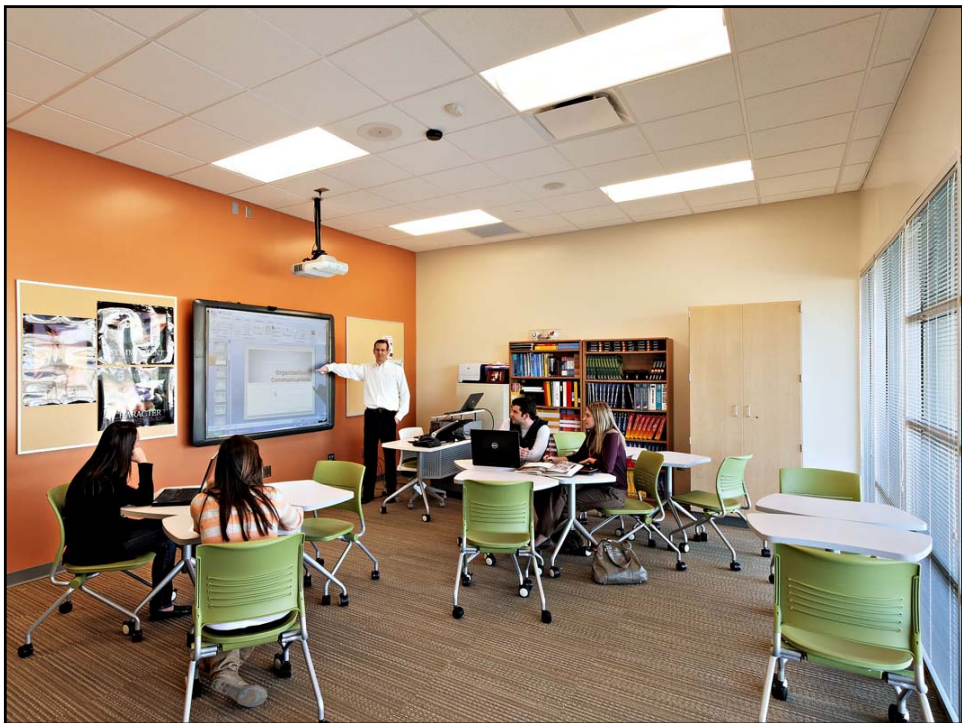
~Rosenthal R & Jacobson L.

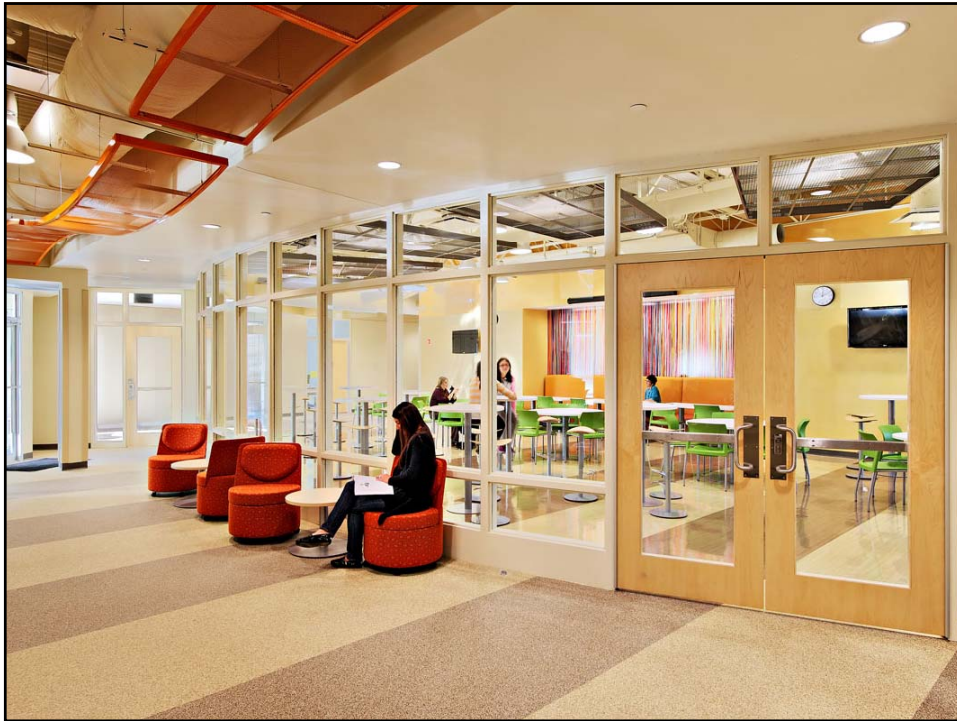
Pygmalion in the classroom: teacher expectation and pupils intellectual development. New York: Holt, Rinehart & Winston, (1968; expanded edition 1992). 240 p. [Harvard Univ., Boston, MA and South San Francisco Unified Sch. District, San Francisco, CA]



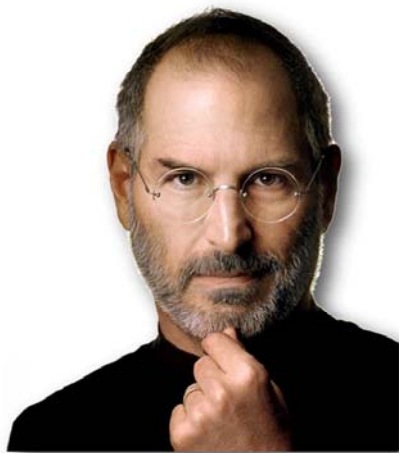








## Relationships



“I know from my own education that if I hadn’t encountered two or three individuals that spent extra time with me, I’m sure I would have been in jail.”

~ Steve Jobs

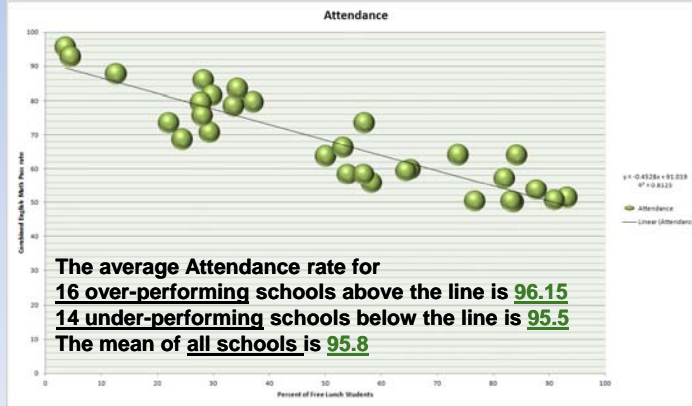
# Combined Pass Rate – Indiana ISTEP+ 2010

## Model Summary and Parameter Estimates

Dependent Variable: **MathEng2010**

Equation	Model Summary	Parameter Estimates			Constant	b1	
Linear	R Square .813	F 121.358	df1 1	df2 28	Sig. .000	91.019	-.453

The independent variable is **FreeLunch**.



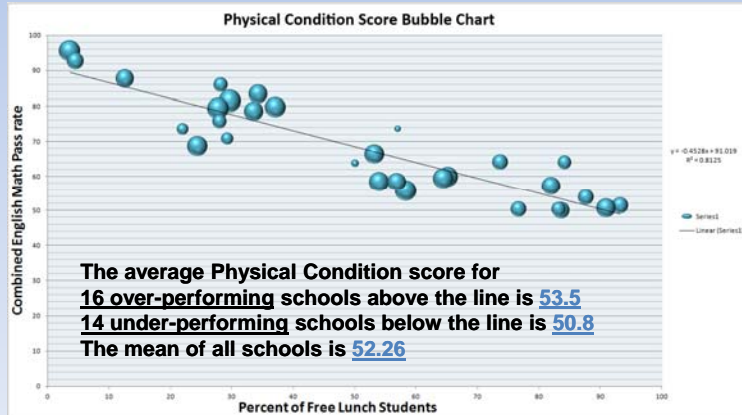
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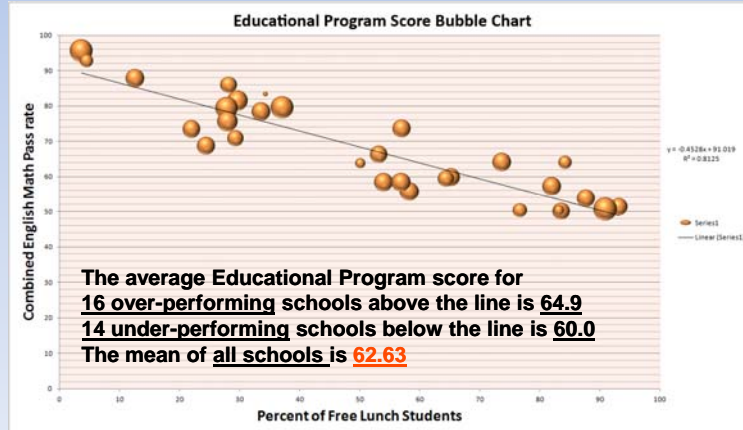
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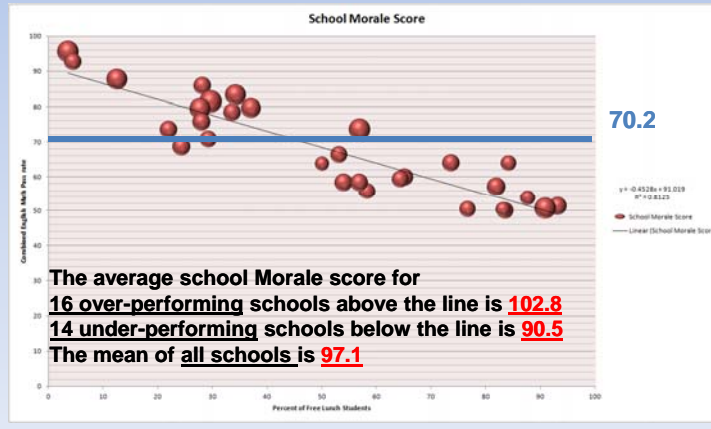
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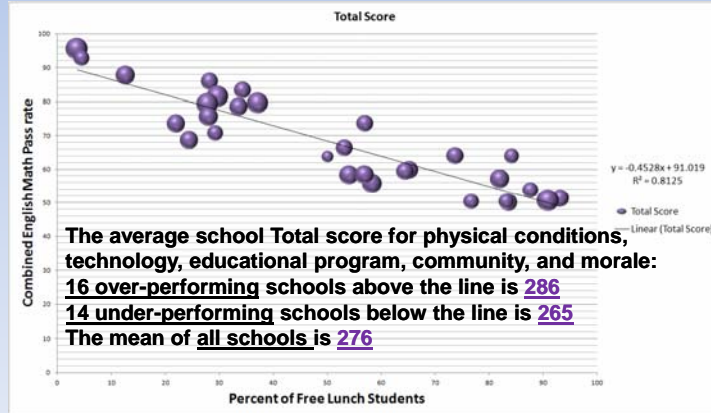
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The independent variable is **FreeLunch**.



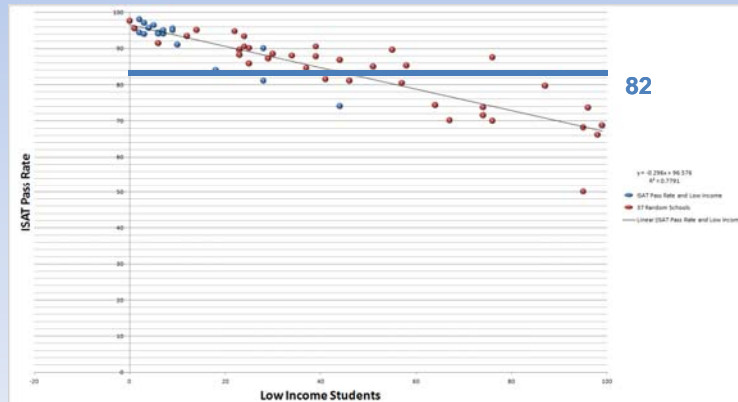
## Combined Pass Rate – Illinois ISAT 2010-11

### Model Summary and Parameter Estimates

Dependent Variable: **ISAT**

Equation	Model Summary	Parameter Estimates			Sig.	Constant	b1
Linear	R Square	F	df1	df2			
	<b>.779</b>	183.359	1	52	<b>.000</b>	96.576	<b>-.296</b>

The independent variable is **LowIncome**.



## Connecting Students, Teachers, and the Environment

### BEHAVIOR CHART $B=f(PE)$

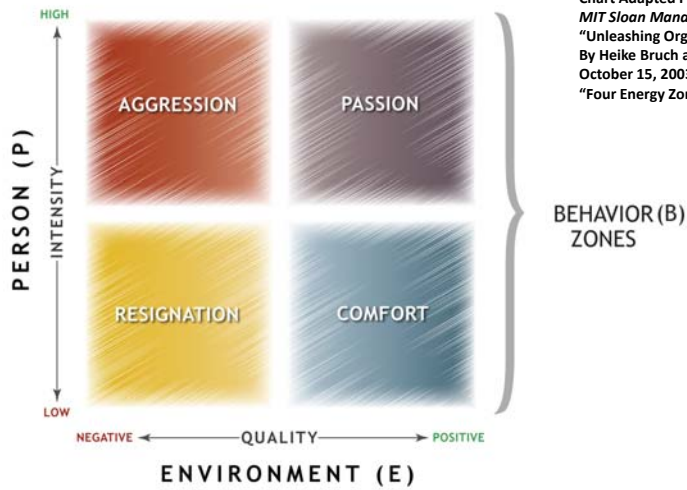


Chart Adapted From:  
 MIT Sloan Management Review  
 "Unleashing Organizational Energy"  
 By Heike Bruch and Sumantra Ghoshal  
 October 15, 2003  
 "Four Energy Zones"

## Course Evaluations

In order to maintain high-quality learning experiences, please access the evaluation for this course by logging into CES Discovery and clicking on the Course Evaluation link on the left side of the page.



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Thank you for your time!

**QUESTIONS??**

CEFPI

This concludes The American Institute of Architects  
Continuing Education Systems Course

**Greg Monberg, AIA, REFP, LEED AP BD+C**

Director of Design Research

Principal, Fanning Howey

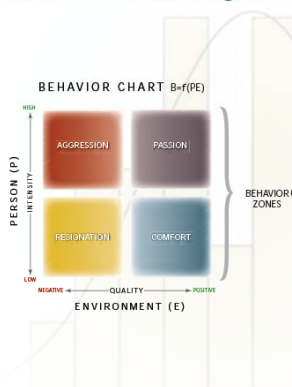
[gmonberg@fhai.com](mailto:gmonberg@fhai.com)

@GHMonberg on Twitter

## Is Your School in the Passion Zone?

### Academic Commissioning of Environments of Schools (A.C.E.S.)

An Evidence-Based Design Initiative



As a national leader in the planning and design of educational facilities, Fanning Howey conducts ongoing research into the variables which most impact student performance and academic success. We are currently seeking out partners across Illinois to participate in these efforts aimed at improving the built environment of schools. All data collected is analyzed in aggregate, keeping the names of individuals, schools and districts anonymous. We freely share the results with our research partners. If you are interested in learning more about how you can help, please contact us.

#### Factors That Affect Student Performance

- Attendance
- Free Lunch Percentage
- Physical Conditions of the Schools
- Technology Integration
- Community Engagement
- Passion

A simple on-line 10 minute survey of your principals can help to improve the decision-making and planning process for schools in your district and beyond.

Link to the Survey: <https://www.surveymonkey.com/s/79P9LRD>

**Greg Monberg, AIA, REFP, LEED AP BD+C**

Director of Design Research

Principal, Fanning Howey

[gmonberg@fhai.com](mailto:gmonberg@fhai.com)

@GHMonberg on Twitter