




# Using Classroom Technology to Enhance The Art and Science of Teaching

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Marzano Research Laboratory  
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## Using Classroom Technology to Enhance The Art and Science of Teaching


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Participants will increase their understanding of:



Possibilities and Cautions
<ul style="list-style-type: none"> <li>Technologies can increase and enhance the use of effective instructional strategies,...</li> </ul>
<p>however, ...they can also be used to perpetuate even exacerbate weak teaching.</p>
<ul style="list-style-type: none"> <li>Teachers these technologies offer extensive testimonial evidence of the positive effects in the classroom...</li> </ul>
<p>however, ...critics of IWBs offer testimonials that show they are used as just expensive chalkboards or more colorful overhead projectors.</p>
<ul style="list-style-type: none"> <li>Teachers who use the technologies report that keep discovering more they can do in the classroom...</li> </ul>
<p>however, ...if teachers are going to use these tools more, they have to decide what they are going to do LESS.</p>



## Interactive Whiteboards (IWB) The Well-known “Wow” Factors


**Engaging students with**

- Visual Impact
- Tools and Techniques
- Interactivity

**Helping teachers through**

- Convenience/Access
- Creative Options
- Collegial Sharing

<p>Evaluation of the DCSF Primary Schools Whiteboard Expansion Project, DCSF and Becta (2007)</p>
<p><i>This study clearly shows the benefits that can be gained from effective use of an interactive whiteboard.</i></p>
<p><i>We know that technology has the capability of <u>bringing lessons to life</u> and making that much <u>more enjoyable for the learner</u>.</i></p>
<p><i>Not only do the lessons become more fun, the study clearly shows the <u>very real benefits in terms of learner attainment</u> and <u>engaging pupils in lessons</u>.</i></p>



## Interactive Whiteboards (IWB) The POTENTIAL “Wow” Factors

**Enhance the Use of Effective Instructional Strategies, e.g.**

- Focusing students on the learning goals
- More effective student processing of new knowledge
- Improving pacing and scaffolding
- Providing means for student-controlled pacing and relearning
- Improving understanding and retention through non-linguistics
- Engaging students in higher-level thinking
- Providing feedback for instructional planning



Learner Response Systems (Clickers)  
The Well-known  
“Wow” Factors

**Engaging students with**

- Accountability for Responding
- Potential anonymous responses
- Focused peer interactions
- Polling for opinions and perspectives

**Helping teachers and schools**

- Understand what students have learned
- Increase response rates
- Use effective formative assessment and instructional feedback



Learner Response Systems (Clickers)  
The Potential  
“Wow” Factors

- Take formative assessment and instructional feedback to new levels

What are you most excited about when you think of the potential of these technologies?

What concerns you?

What Research Tells Us So Far?

Overall Effects

Uncorrected			Corrected		
ES	Percentile Gain	Fail-safe N	ES	Percentile Gain	Fail-safe N
.37 (N=85)	<b>14</b>	3,060	.44 (N=85)	<b>17</b>	3,655

## Overall Effects

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.37 (N=85)	14	3,060	.44 (N=85)	<b>17</b>	3,655

### Meta-Analysis of CSR Models

Borman et al, 2003. Review of Educational Research

- Looked at 1,100 studies
- Average Effect Size = .15;  
Gain = 6 percentile points

(As compared with Effect Size = .44:  
Gain = 17 percentile points)

But you can't just give the technology  
to teachers and expect it to  
automatically enhance student  
achievement.

This is because 23% of the effect  
sizes were below 0.

### Meta-Analysis of CSR Models

Borman et al, 2003. Review of Educational Research

- Looked at 1,100 studies
- Average Effect Size = .15; Gain = 6 percentile points
- Range: -2.13 to +7.83
- 35% of effect sizes were below zero

Phase II  
Correlation Study

Variables Analyzed

1. Engagement
2. Teacher IWB skill
3. Student IWB skill
4. Multiple student use of IWB
5. Student independent use of IWB
6. Use of IWB reinforcers
7. Use of voting
8. Nonlinguistic representation of content

Variables Analyzed

9. Previewing/reviewing content
10. Chunking content
11. Scaffolding content
12. Pacing
13. Monitoring student progress
14. Clarity of content on IWB
15. Students interacting about content
16. Response rate
17. Management

Correlations

Var	r uncor	r cor	Sig	Pgain (1)	Pgain (2)
Engage	.501	<b>.504</b>	.000	19	34
Teach IWB skill	.334	<b>.338</b>	.004	13	25
Stdnt IWB skill	.001	<b>.006</b>	.993	0	0
Mult use IWB	.421	<b>.423</b>	.000	16	30
Stdnd ind use IWB	-.009	<b>-.012</b>	.941	0	0
IWB Reinforcers	.393	<b>.395</b>	.001	16	29
Voting	.321	<b>.329</b>	.004	13	25
Non-linguistic	.334	<b>.334</b>	.004	13	25

Var	r uncor	r cor	Sig	Pgain (1)	Pgain (2)
Preview/Review	.283	<b>.284</b>	.015	11	21
Chunking	.794	<b>.791</b>	.000	29	44
Scaffolding	.715	<b>.715</b>	.000	26	43
Pacing	.720	<b>.716</b>	.000	26	43
Monitoring	.726	<b>.726</b>	.000	27	43
Clarity of IWB	.646	<b>.641</b>	.000	24	40
Students Interacting	.352	<b>.357</b>	.002	14	26
Response Rate	.670	<b>.672</b>	.000	25	41
Management	.348	<b>.350</b>	.002	14	26

So.....


To realize the potential of the technologies,

Work from an Agreed-Up  
Model/Language of Instruction

**Three Instructional Commitments to Students**


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Commitment #1: Provide Feedback Through Classroom Formative Assessment and Grading





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Commitment #2: Foster and Support Effective Teaching in Every Classroom




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Commitment #3: Build Background Knowledge for All Students



**Three Instructional Commitments to Students**

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**Commitment #2:**  
Foster and Support  
Effective Teaching in Every Classroom

**How to measure teacher expertise?**

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Evidence of...

- Students' knowledge gain
- Students' perceptions of their learning

**How to improve teacher expertise?**

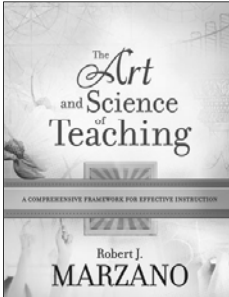
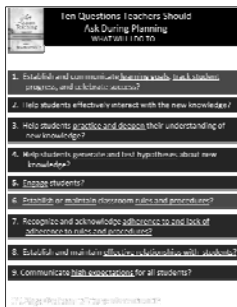
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- Develop an agreed-upon common language/model of instruction.

A Common Language/Model of Instruction...

- Defines the areas of teacher expertise considered important to the school and provides focus for instructional improvement.


For Example

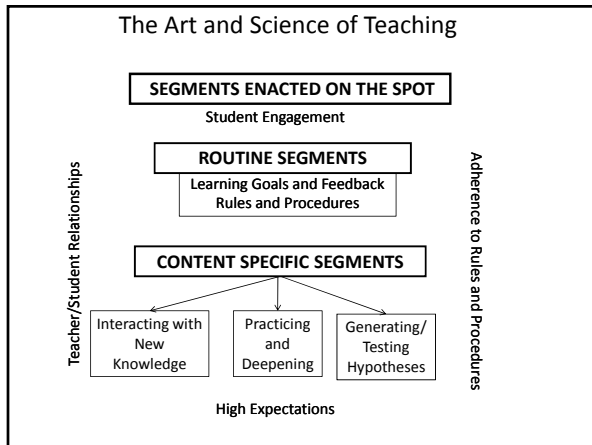
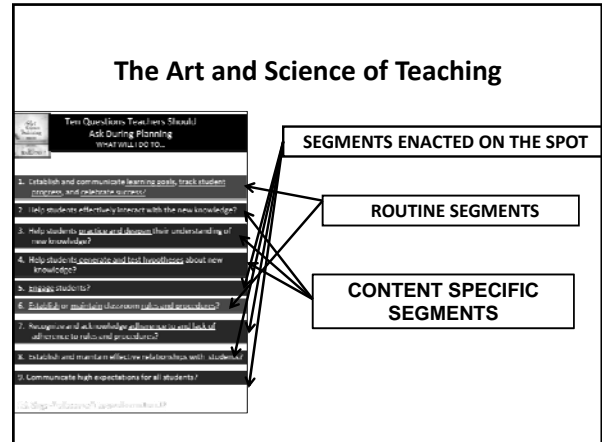



**Ten Questions Teachers Should Ask During Planning**

WHAT WILL I DO TO...

1. Establish and communicate learning goals, track student progress, and celebrate success?
2. Help students effectively interact with the new knowledge?
3. Help students practice and deepen their understanding of new knowledge?
4. Help students generate and test hypotheses about new knowledge?
5. Engage students?

 <p>Ten Questions Teachers Should Ask During Planning</p> <p>WHAT WILL I DO TO...</p>
6. <u>Establish and maintain classroom rules and procedures?</u>
7. Recognize and acknowledge <u>adherence to and lack of adherence to rules and procedures?</u>
8. Establish and maintain <u>effective relationships with students?</u>
9. Communicate <u>high expectations</u> for all students?
10. Organize lessons into a <u>coherent unit?</u>

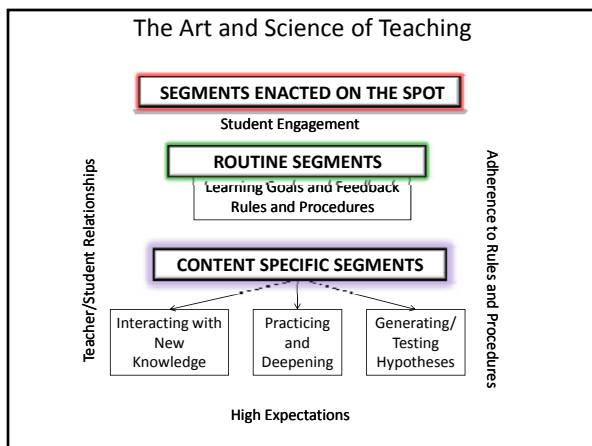


### SEGMENTS ENACTED ON THE SPOT

ROUTINE SEGMENTS

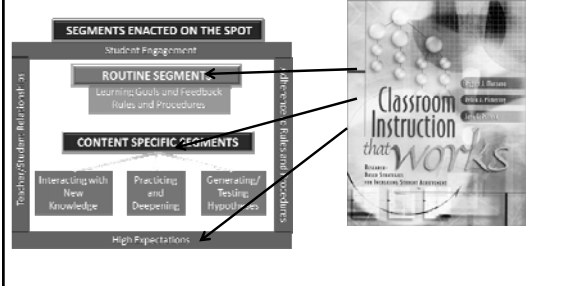
CONTENT SPECIFIC SEGMENTS

- Whatever model you use, adapt, or create, make sure you keep the three types of segments in mind.
- When observing in classrooms—for any reason—first ask “What type of segment(s) am I observing here?”
- You could then look for particular strategies, and the effective use of those strategies.



### If school had such a Model/Language of Instruction...

...when new ideas/products emerge...



The diagram shows the same hierarchy of segments as the previous block, but with arrows pointing from each level to a book cover titled 'Classroom Instruction that Works'. The arrows indicate that the model informs the book's content.

**If school had such a Model/Language of Instruction...**

The diagram shows a hierarchical structure of instructional segments. At the top is 'SEGMENTS ENACTED ON THE SPOT' (Student Engagement). Below it is 'ROUTINE SEGMENTS' (Learning Goals and Feedback Rules and Procedures). At the bottom is 'CONTENT SPECIFIC SEGMENTS' (Interacting with New Knowledge, Practicing and Deepening, Generating/Testing Hypotheses). The entire structure is framed by 'Teacher/Student Relationships' on the left and 'Adherence to the Procedures' on the right. The base is labeled 'High Expectations'.

**...when new ideas/products emerge...**

The book cover for 'Classroom Management that Works' by Robert J. Marzano features a young boy looking thoughtful.

**If school had such a Model/Language of Instruction...**

The diagram is identical to the one in the first panel, showing the hierarchy of instructional segments from Student Engagement down to High Expectations.

**...when new ideas/products emerge...**

The book cover for 'Managing Your Classroom with Heart' by Katy Ritouner features a young boy standing in a classroom.

**If school had such a Model/Language of Instruction...**

The diagram is identical to the previous panels, showing the hierarchy of instructional segments.

**...when new ideas/products emerge...**

The book cover for 'Beyond Discipline: From Compliance to Community' by Alfie Kohn features a close-up of leaves.

**If school had such a Model/Language of Instruction...**

The diagram is identical to the previous panels, showing the hierarchy of instructional segments.

**...when new ideas/products emerge...**

A collection of modern electronic devices including a laptop, a tablet, and several mobile phones, representing digital technology in the classroom.

**How to improve teacher expertise?**

- Develop an agreed-upon common language/model of instruction.

Small versions of the instructional model diagram and the book covers for 'Classroom Management that Works' and 'Beyond Discipline' are shown at the bottom of the slide.

**Working from an Agreed-Upon Model/Language of Instruction**



Get Science Teaching  
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# ROUTINE SEGMENTS

## Learning Goals and Feedback Rules and Procedures

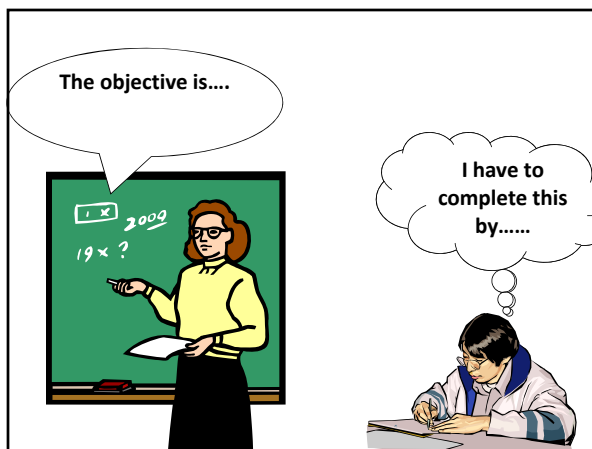
Even without considering technology, we know that when students know what they are learning and are focused on the learning goals, they achieve higher than students without this advantage.

Synthesis Study	Focus	# of Effect Sizes	Avg. Effect Sizes	%ile Gain
1	General Effects of setting goals and objectives	3 25	1.37 0.48	<b>41</b> <b>18</b>
2	"	204	0.55	<b>21</b>
3	"	21	0.40	<b>16</b>

### Learning Goals

**Learning Goals** are clear statements of what students are learning, separate from what they will do to demonstrate that learning.

- ### Are the Learning Goals
- ✓ Clear?
  - ✓ Important?
  - ✓ The focus?



- Clear?: Are these Activities/Assignments or Learning Goals?????**
- Students will :
- Add and subtract fractions
  - Understand that primary sources provide unique insights into history.
  - On a blank map of the United States, label each state.
  - Identify similarities and differences between themselves and Emily Dickinson.
  - Create a simple machine
  - Know the major types of volcanoes
  - Understand that literature can both influence and reflect a society
  - Create a travel brochure

**Are the Learning Goals Clear? Important? The Focus?**

---

Nonfiction Rocks

During this quarter, you are required to read two nonfiction books. One of the books must be a biography or autobiography.

After you have read the biography or autobiography, you are to prepare a creative presentation for the class focused on the person from this book. This presentation should help us understand what you learned from the book.

You must wear a costume for the presentation. You should be dressed like the character or wear something symbolic of the character you read about in the biography or autobiography Be creative!!!

The presentations will all be given the week of... Pay close attention to the rubric below.

RUBRIC:

RUBRIC:

1. Thorough <b>introduction and conclusion</b>	<b>10 pts</b>
2. <b>Costume</b> (well planned, creative, complete, includes a prop)	<b>10 pts</b>
3. <b>10 important pieces of information</b>	<b>10 pts</b>
4. <b>Presentation</b> (interesting voice, good posture, good eye contact, loud enough, practiced)	<b>10 pts</b>
5. <b>Memorization</b> 2 – 4 minutes long	<b>10 pts.</b>

**50 POINTS POSSIBLE**

Your grade \_\_\_\_\_

**Are the Learning Goals**

- ✓ Clear?
- ✓ Important?
- ✓ The focus?

**Are the Learning Goals Clear? Important? The Focus?**

---

So WITH technology, we can

- Design materials that clearly communicate Learning Goals throughout the lessons.
- Spend the time on **important** learning goals.
- Make sure the assignments/lessons serve to focus student on the learning goals.

**Are the Learning Goals Clear? Important? The Focus?**

---

**Cautions and concerns**

- Observation: When examining whiteboard lessons we find online, we have noticed that a high percentage of learning goals are at the basic (terms/detail) level .

Suggestion: As the lessons for declarative knowledge are designed, consider designing units with a focus on Principles and Generalizations

**Understanding the types of knowledge within Learning Goals...**

**Information and Ideas--Declarative Knowledge**

Organizing Ideas: Principles and generalizations  
 Terms and Details: (vocabulary, facts, time sequences)

**Skills and Processes—Procedural Knowledge**

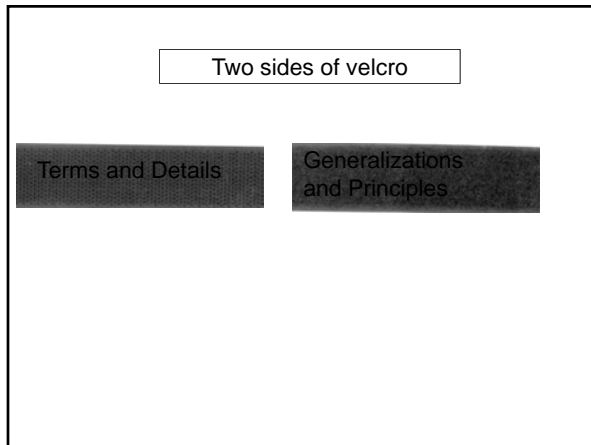
Mental Procedures  
 Psychomotor Procedures

**Information and Ideas--Declarative Knowledge**

Organizing Ideas: Principles and generalizations  
 Terms and Details: (vocabulary, facts, time sequences)

**Skills and Processes—Procedural Knowledge**

Mental Procedures  
 Psychomotor Procedures



**Information and Ideas--Declarative Knowledge**


<p><u>Terms and Details:</u> (vocabulary, facts, time sequences)                  Students will demonstrate an understanding of...</p> <p>The topographical features of California.</p> <p>The plot and theme of <u>To Kill a Mockingbird</u>.</p> <p>The distinguishing features of a penguin.</p> <p>The major causes, people, and events of the American Civil War.</p>	<p><u>Organizing Ideas:</u> Principles and generalizations                  Students will demonstrate an understanding of...</p> <p>Topography and natural resources influence the culture of a region.</p> <p>Literature can both reflect and influence a society...</p> <p>Animals have characteristics that are examples of adaptation</p> <p>???????</p>
--	--

**Information and Ideas--Declarative Knowledge**

<p><u>Terms and Details:</u> (vocabulary, facts, time sequences)                  Students will demonstrate an understanding of...</p>	<p><u>Organizing Ideas:</u> Principles and generalizations                  Students will demonstrate an understanding of...</p>
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**Inventors**

5-3.1 Identify prominent inventors and scientists of the period and summarize their inventions or discoveries, including Thomas Edison, Alexander Graham Bell, the Wright Brothers, and Albert Einstein (1)



What SHOULD you have learned while doing your projects last week?

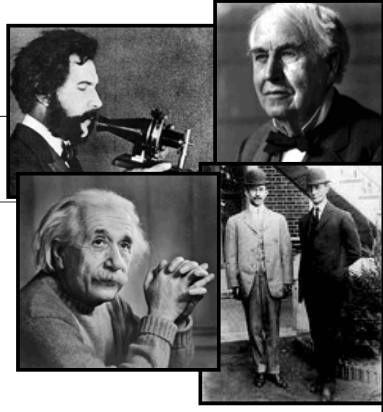
Inventors



A makeover with a focus on Generalizations/Principles

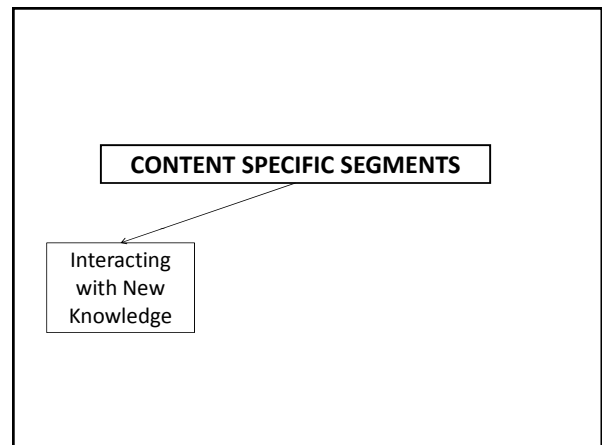
What SHOULD you have learned while doing your projects last week?

Inventors



Students will increase their understanding of the following:

- The lives and contributions of specific inventors (Einstein, Wright Brothers, Edison, Bell)
- **FACING OBSTACLES AND CHALLENGES:** Those who have contributed to our lives often must face obstacles and challenges to their ideas and work. (Ex: social, economic, physical, and personal)
- **THE PROCESS OF INVENTION involves:**
  - ✓ Identifying a need
  - ✓ Setting standards
  - ✓ Drafting, testing, and revising to meet standards




When learning new knowledge, to what extent are students interacting with that new knowledge...through:

- previewing what they already know?
- processing the knowledge in appropriate chunks?
- interacting with peers as they process the knowledge?
- elaborating on what they are learning?
- recording what they are learning?
- reflecting on their learning?

To what extent are student interacting with new knowledge?

**Results from study**

Var	r uncor	r cor	Sig	Pgain (1)	Pgain (2)
Preview/Review	.283	<b>.284</b>	.015	11	<b>21</b>
Chunking	.794	<b>.791</b>	.000	29	<b>44</b>
Scaffolding	.715	<b>.715</b>	.000	26	<b>43</b>
Pacing	.720	<b>.716</b>	.000	26	<b>43</b>

 To what extent are student interacting with new knowledge?

- Design flipcharts with clear attention to the strategies that help students interact with new knowledge.
- Use the unique features of IWBs and Clickers to expand on the approaches to students interacting with new knowledge.

Special Topic:  
Nonlinguistic Representations

Special Topic  
Nonlinguistic Representation

**To Teach**

- Include nonlinguistic representations in presentations of new knowledge
- Use internet and other media to help with quality and variety in nonlinguistic representations
- Use dramatic (kinesthetic) enactments of events and idea

Special Topic  
Nonlinguistic Representation

**To Learn**

- Cue students to generate mental images– in class and as study strategy
- Help students practice using mnemonic devices that are based on images (peg word, link word)
- Have student draw/represent their learning
- Ask students to generate nonlinguistic representations to elaborate on notes (pictorial, graphic, symbolic)


Special Topic  
Nonlinguistic Representation

Results from study

Var	r uncor	r cor	Sig	Pgain (1)	Pgain (2)
Non-linguistic	.334	<b>.334</b>	.004	13	<b>25</b>

Special Topic  
Nonlinguistic Representation


- There are so many visuals built into IWB software and it is so easy to pull in online resources that illustrate key points
- The visuals are compelling and the color and variety can enhance student retention



Multimedia Learning  
Richard E. Mayer


People learn better from words and pictures than from words alone.

However,




Multimedia Learning  
Richard E. Mayer

Active Instruction  
and  
Passive Instruction



Active-Passive Learning


Level of Behavioral Activity	Level of Cognitive Activity	
	Low	High
High Behavioral= <u>Active Instruction</u>		
Low Behavioral= <u>Passive Instruction</u>		



Multimedia Learning  
Richard E. Mayer

People learn better from words and pictures than from words alone.


However,



Multimedia Learning  
Richard E. Mayer

**Foster generative processing**

- Help students process content by using both words and images to make sense of the material.
- Carefully select, organize, and integrate words and images.



Multimedia Learning  
Richard E. Mayer

**Reduce extraneous cognitive processing.**

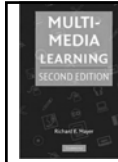
- Get rid of sounds, graphics, and words that distract from the essential information and that do not contribute to meaning.



Multimedia Learning  
Richard E. Mayer

**Reduce extraneous cognitive processing.**

- Get rid of sounds, graphics, and words that distract from the essential information and that do not contribute to meaning.
- Place key words next to the relevant graphic.



Multimedia Learning  
Richard E. Mayer

**Manage essential cognitive processing.**

- Use “pre-training” to make sure learners are familiar with the terms for key concepts before using multimedia to increase understanding of those concepts.
- Break content into “segments.”

So.....  
To realize the potential of the technologies,  
Work from an Agreed-Upon  
Model/Language of Instruction