Critical Thinking and Problem Solving

Examples of Practice

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Critical Thinking & Problem Solving

Yesterday
• What is it?
• Why is it important?

Set of thinking skills + willingness to use them + recognition that they’re relevant in new contexts (transfer)
Critical Thinking & Problem Solving

Today

• How can you promote & develop it in students, teachers, administrators, community?

The WHAT…the WHY…

ELEVATOR SPEECHES?
Example Models

• Harvard’s Project Zero:
  – (See Tishman, Perkins, & Jay, Thinking Classroom)

• Diane Halpern
  – (See Thought & Knowledge)

• Edward de Bono’s CoRT Course

Models & resources:

• Make thinking processes and tendencies explicit
• Slow down thinking, broaden it
• Make it more intentional and reflective
• Focus on practice (not rote), habit, culture
• Help battle limitations in the way people deal with information
The Thinking Classroom (Tishman, Perkins, & Jay’s Framework)

Culture of Thinking
• Language of Thinking
• Thinking dispositions
• Mental management (metacognition)
• Strategic spirit
• Higher order knowledge
• Transfer

Strategy = Explicit, articulate plan for tackling an intellectual challenge.

The Thinking Classroom (Tishman, Perkins, & Jay’s Framework)

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Teachers:
• Model it
• Explain explicitly
• Encourage interaction
• Provide ongoing feedback
Strategic Spirit (Consider and weigh multiple options before decision making)

Combine: Best of both

Option 1

Should you stop buying items made in sweatshops?

Option 2

Compromise between Options

Source: Harvard, Project Zero

Take a moment to reflect …

Your experience about the process?

Insights about promoting the “how” in students, teachers, yourself?

Challenges that you’ll have to solve along the way?
FourThought (supporting metacognition)

1. Before Thinking: Get ready

Thinking Challenge: Will you stop buying items produced in sweatshops?

2. During Thinking: Set Goals & Standards

4. After Thinking: Reflect

Source: Thinking Classroom

Halpern’s Model:

- Teach critical thinking skills explicitly
  - Deductive Reasoning
  - Argument Analysis
  - Hypothesis Testing
  - Uses of Probability
  - Decision Making
  - Problem Solving
  - Creative Thinking
Halpern’s Model:

- Teach critical thinking skills explicitly
- Develop students’ disposition for effortful thinking and learning
- Train for transfer
- Support and teach metacognitive thinking explicitly

ARGUMENT ANALYSIS: Evaluate the strength of Molina’s argument.
Halpern’s 4 Step Process

1. What is the Goal?
   - e.g., decide between 2 options?
   - Generate a new solution?
   - Evaluate an argument or evidence?

2. What is Known?
   - No
     - 4. Have You Reached Your Goal?
       - Yes
         - Success
       - No
         - Reflection

3. Which Thinking Skills Will Get You To Your Goal?
   - E.g., diagram structure of argument, evaluate each premise, look for missing information or assumptions

4. Have You Reached Your Goal?

Example of strategies:

Edward deBono: CoRT
- PMI (Plus Minus Interesting)
  - Works against hasty, narrow thinking
Question…

Should all cars in the US should be painted bright yellow?

Before you answer …
• Don’t be hasty, think about ideas, even crazy ones.
• Use PMI (Plus Minus Interesting)

Can we teach these qualities?

Venezuela’s program to increase cognitive development
• CoRT
• Project Intelligence (Odyssey)
Critical Thinking in Practice…
Teaching for Understanding

IMMEX

http://immex.ucla.edu
Sample IMMEX Problem

An earthquake just hit your school

An unmarked container is damaged and the contents are spilling out

Can you identify the chemical that was spilled so that you can dispose of it properly before it becomes a hazard to the school?

IMMEX … NAVAL BATTLE

You are the commander of the navy aircraft carrier USS John F. Kennedy. Your ship has just been hit by an enemy torpedo. You must determine which of the surrounding ships in the area had the capability and range to carry out this attack. Your decision will determine the retaliatory measures necessary. Which ship hit you? Click on STATUS REPORTS for details.
Figure 6. Sequence of performance of one student on three True/False cases.

Remember your algebra teacher...
INTERNATIONAL PROJECTS

"How will this project improve the quality of life on the planet?"
Grades 1-2

Web-based Integrated Science Environment (WISE)

- Scaffolds scientific inquiry
- Students use real data to conduct scientific investigation
- Online tools help them reflect, organize observations, visualize patterns in data

http://wise.berkeley.edu
WISE
Web-based Integrated Science Environment

• How far does light go?
• How safe are airbags?
• Should you eat genetically modified food?
• Why are frogs showing up deformed all over the world?

Important Points About these Efforts

• Do not deny importance of basic skills BUT
• Emphasize authentic work
• Help students deal with the thinking difficulties we experience (e.g., memory)
• Integrate reflection
• Technology is JUST a tool -- it’s not the purpose
Assign Intellectually Rigorous, Authentic Work

Students Learn More in Classrooms with High Quality Assignments: Effects on On-Year ITBS Gains

Source: Improving Chicago's Schools, Fred Newman 2001

Memory

The fallacy of the “tape recorder” analogy.

The importance of generative learning.

Gazzaniga & Heatherton (2003); Psychological Science.

The value of basic skills from this perspective. The importance of attention.
More on the HOW & Additions to the WHAT / WHY …

Your experience about the process? Insights about promoting the “how” in students, teachers, yourself?

Challenges that you’ll have to solve along the way?

Extras …

• Examples of additional projects that engage students in active learning and critical thinking.
**Vocabulary Words**

Smith's 9th Honors Class Blog

Wonder Woman Gone Country

Every week in English Nine Honors, students are given a set of ten SAT preparatory vocabulary words. Last week's words were astute, asylum, atone, atrocity, atrophy, attrition, augment, augur, authentic, austere. They are expected to know...

http://annesmith9h.blogspot.com/2006/10/wonder-woman-gone-country.html

**SimCalc**

A focus on proportionality

Proportionality is critical to the transition from middle school to high school mathematics and science. Proportionality includes:

- linearity
- rate
- function
- slope in graphs
- interpreting tables with an underlying rate

Jim's Contribution: Integrated Curriculum & Technology

SimCalc restructures the pathway to knowing by changing the classroom representational infrastructure to feature dynamic, linked representations.

Algebra
Motion Phenomena
Graphs
Tables
SimCalc

Figure 6: Adjusting a motion with “snap to grid” enabled

Figure 7: Enabling “snap to grid”

You Make the Call

http://library.thinkquest.org/J001709/thinkquest_values/make_call/start.html
www.metiri.com
See Presentations Page for Resources

What's New?

HOT OFF THE PRESSESS! With help from Metiri, the State Education Technology Directors Association (SETDA) has officially released its 2005 National Trends Report. Intended to inform national policymakers on the progress of state and local education agencies in achieving NCLB II D goals, the report also offers up-to-date information on the strategies and tactics states and school districts are using to get results. Download key facts and findings here, or check out the full report at: http://www.setda.org/

Metiri's Technology Solutions that Work (TSW) Database is Expanding!

Looking to inform your decision-making about technology with sound, reliable research? Finding it difficult to locate research aligned to your interests, and even more difficult to know which research findings are significant and which are not? Now available for Early Literacy and Middle School/High School Mathematics, Metiri's Technology Solutions that Work (TSW) database puts research at your fingertips, providing an in-