In this presentation we will explore the **centrality of thinking to learning** and look at ways in which the teaching of skillful thinking can be infused into the teaching of mandated content.

Recent research on the brain and its function has led to a new understanding of *How People Learn*. This knowledge suggests how teaching can be changed to increase effectiveness.

We will review these ideas and discuss how they can be integrated into the teaching world we face today.


What is the significant core of education?

*teaching children skillful thinking while teaching significant content*

This core is in danger of being overlooked due to the pressures of high stakes testing.

We will describe how to infuse the teaching of skillful thinking into the curriculum.

Here is a Question to Start Us Off

Let’s go back a few years...

What do you want students to be able to do five years after they leave your classroom or school?
This report describes a synthesis of recent research by cognitive psychologists, developmental researchers, social psychologists, cognitive psychologists, anthropologists, neuroscientists, and educators and leads to three significant findings.

**Finding 1**

“Students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged they may fail to grasp the new concepts and information that are taught, or they may learn them for the purpose of a test but revert to their preconceptions outside the classroom.”


**Uncovering Preconceptions**

What students hear or learn may be very different from what we think we told or taught them. What students hear will depend on their prior experiences.

**Student Preconceptions**

... result from children’s initial effort to figure out how the world works, ... can be deep seated and difficult to change, ... are able to “explain” the world at least partially, ... they may interfere with learning.


“Educational researchers have shown that the activation of prior knowledge is critical to learning of all types. Indeed, our background knowledge can even influence what we perceive.”

*Classroom Instruction That Works*, Marzano, Pickering & Pollock, ASCD 2001
Misconceptions vs. Preconceptions

We may need to un-teach as well as teach

We don’t want to waste time teaching what students already know

Finding 2

To develop competence in an area of inquiry, students must:
(a) have a deep foundation of factual knowledge,
(b) understand facts and ideas in a context of a conceptual framework, and
(c) Organize knowledge in ways that facilitate retrieval and application.


Chess Expertise

Experts develop patterns of meaningful information.

Chess Expert vs. Novice


Transformation of Students

Adapted from John Bransford and the “Center for Learning in Formal and Informal Environments”.

Experts versus novices

Experts acquire new information and organize it differently from novices.

Experts may transfer (teach) information but not the organization of information. That takes place in the student’s own mind.
That means that students should think about how they learn and how they organize information. The process of “study” is largely about organizing information so that it can be accessed and used efficiently.

Finding 3

A metacognitive approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them.


Metacognition

Thinking about thinking

• Arthur Costa and Bena Kallick have developed 16 Habits of Mind

• These are dispositions to behaving intelligently when faced with a problem where the solution is not immediately known

An important reminder

The ability to think skillfully and reflect on our thinking is not an innate human characteristic. These skills need to be explicitly taught to children.

Research has shown that around 30% of the adult population does not engage in metacognition.


Habits of Mind

The habits of Mind were developed by Arthur Costa and Bena Kallick.

Personal Traits
– Persisting
– Managing impulsivity
– Striving for accuracy
– Finding humor

Acquiring Information
– Gathering data through all senses
– Listening with understanding and empathy
– Questioning and posing problems
– Thinking interdependently

Thinking Tools
– Thinking flexibly
– Thinking and communicating with clarity and precision
– Applying past knowledge to new situations
– Remaining open to continuous learning

Personal Responses to Thought
– Creating, imagining, innovating
– Responding with wonderment and awe
– Thinking about thinking (metacognition)
– Taking responsible risks

What is a Habit?

Unconscious Incompetence

Conscious Incompetence

Conscious Competence

Unconscious Competence
Important Types of Thinking That Students Should Become Skillful At Using
adapted from Robert Swartz and the National Center for Teaching Thinking

I. GENERATING IDEAS
1. Alternative Possibilities
   a. Multiplicity of Ideas
   b. Varied Ideas
   c. New Ideas
   d. Detailed Ideas
2. Composition
   a. Analogy/Metaphor

II. CLARIFYING IDEAS
1. Analyzing Ideas
   a. Compare/Contrast
   b. Classification/Definition
   c. Parts/Whole
   d. Sequencing
2. Analyzing Arguments
   a. Finding Reasons/Conclusions
   b. Uncovering Assumptions

III. ASSESSING THE REASONABILITY OF IDEAS
1. Assessing Basic Information
   a. Accuracy of Observation
   b. Reliability of Sources
2. Inference
   a. Use of Evidence
      i. Causal Explanation
      ii. Prediction
      iii. Generalization
      iv. Reasoning by Analogy
   b. Deduction
      i. Conditional Reasoning (If … then …)
      ii. Categorical Reasoning (Some … All …)

IV. COMPLEX THINKING TASKS
1. Decision Making
2. Problem Solving
3. Planning
4. Systems Thinking

The Habits of Mind provide us with the dispositions needed for skillful thinking and a language with which to develop the ability to think and talk about our thinking - metacognition

What Educators Need to Do
Identify preconceptions and deal with them.
Provide a conceptual structure for knowledge.
Introduce students to metacognition.
All this in an environment with an imperative to pass Standards of Learning.

What does this knowledge add to our ability to deal with the SOLs?

<table>
<thead>
<tr>
<th>Positives</th>
<th>Dangers</th>
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<tbody>
<tr>
<td>Focus on performance</td>
<td>MC questions often tend to focus on “inert knowledge”</td>
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<tr>
<td>Setting of standards</td>
<td>Temptation to triage – although AYP mitigates against this</td>
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<tr>
<td>Accountability</td>
<td>Pressures on teachers lead them to look for quick “drill &amp; recall” teaching rather than more time consuming teaching to think</td>
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Stages of Metacognition
Being AWARE of the kind of thinking you are doing.
Knowing the STRATEGY you are using to do the thinking.
REFLECTIVELY evaluating the effectiveness of your thinking.
PLANNING how you will do the same kind of thinking the next time it is needed.

Developed by David Perkins and Robert Swartz.
Disaggregation of the fabric of knowledge

Knowledge is a complex fabric of interwoven strands. We are in danger of separating out the strands and expecting students to “suck them up” one strand at a time, like eating spaghetti.

Integration of content

We must take advantage of the rich opportunities for students to develop their ability to transfer knowledge.

This is one of the characteristics of an ‘expert’.

Grade 4 Physical Education

The student will understand and apply movement concepts and principles in complex motor skills.

Recall and demonstrate movement principles and concepts for selected motor patterns and combination skills (e.g., trajectory, force, speed).

Grade 4 Science

Students should be able to:

- describe the position of an object; collect and display in a table and line graph time and position data for a moving object
- explain that speed is a measure of motion; interpret data to determine if the speed of an object is increasing, decreasing, or remaining the same
- identify the forces that cause an object’s motion; describe the direction of an object’s motion: up, down, forward, backward

Grade 4 Mathematics

Collect data, using, for example, observations, measurement, surveys, scientific experiments, polls, or questionnaires.

Organize data into a chart or table. Construct and display data in bar graphs.

Analyze information from simple line and bar graphs by describing the characteristics of the data and the data as a whole.

Interpret the data to answer the question posed, and compare the answer to the prediction.

A thoughtful, integrated learning opportunity

Physical Education tasks of movement, trajectory, force, speed

Mathematical skills of collecting and representing data

Scientific understandings of motion: position, speed and forces
Much of what children learn at school may not be obviously linked to any specific SOL, but it may be very valuable and it may be teaching important Habits of Mind or thinking skills.

In the classroom, carefully structured lessons ensure that SOL content is being taught.

Children’s learning is planned and directed by the teacher.

Putting on a performance requires persistence, thinking interdependently, creating, imagining and innovating and taking responsible risks.

Dr Seuss Day involves children responding with wonderment and awe, applying past knowledge to new situations, creating, imagining and innovating and finding humor.

Getting on with your friends requires finding humor, listening with empathy and understanding, managing impulsivity.

These are some of the dispositions or Habits of Mind that children need in order to successfully engage in the cognitive tasks and thinking skills required by the SOLs.
There is more to successful education than the teaching of content.

“There are countless intellectually competent kids who unravel in school because they understand far better than they remember. Ironically, there are many students with superb memory who succeed with flying colors through their school years simply by regurgitating factual data. They may be far less successful during adult careers when memory plays much less of a starring role”


How much of learning is measured by the SOLs?

• It is not enough for us to just teach ‘stuff’
• Content is the grist for the mill of the process of learning
• The real task is to teach children how to think, how to find out, and how to use what they find out

• What use is it if a child gets a high score in an SOL Direct Writing test but never wants to pick up a pen and use writing to express himself or to explore his thoughts?

• What use is it if a child scores 500+ on the SOL reading test if she never voluntarily picks up a book and considers it to be a significant source of entertainment and information?
• What use is it if a child understands the difference between natural and manufactured resources but has no sense of a personal need to conserve resources?

These kinds of learning are valuable if they are a part of our core task, to teach children how to think using significant content.

Infusing thinking into the SOLs

It doesn’t have to be one or the other:

- teaching content
- or
- teaching thinking

Effective thinking requirements
What kinds of thinking skills are required by the SOLs?

Virginia Studies 2d
Analyze and interpret maps

Mathematics 4.3
The student will use problem solving, mathematical communication, mathematical reasoning, connections, and representations to:

- Compare two fractions having denominators of 12 or less, using manipulative models and drawings, such as:
  - region/area models (e.g., fraction circles, pattern blocks, geoboards, color tiles, graph paper, drawings);
  - set models (e.g., two-sided counters, chips, drawings); and
  - measurement models (e.g., cuisenaire rods, unifix cubes, fraction strips, rulers/number lines, drawings).
- Compare two fractions with like denominators by comparing numerators.
- Compare two fractions having unlike denominators of 12 or less by comparing the fractions to common benchmarks (e.g., or 1) to determine their relationship or by finding a common denominator.

English 4.5
The student will read and demonstrate comprehension of nonfiction.

- Use text organizers, such as type, headings, and graphics, to predict and categorize information.
- Formulate questions that might be answered in the selection.
- Explain the author’s purpose.
- Make simple inferences, using information from texts.
- Summarize content of selection, identifying important ideas and providing details for each important idea.
- Describe relationship between content and previously learned concepts or skills.
- Distinguish between cause and effect and between fact and opinion.
- Identify new information gained from reading.

The SOLs are filled with “thinking verbs”

- apply, differentiate, use, create, diagram, analyze.
- Interpret, compare, contrast, explain, construct, predict.
- demonstrate, comprehend, categorize, formulate, question, problem solve.
- reason, summarize, make connections, describe relationships, differentiate between, distinguish cause and effect.

These verbs are not discipline based.

They apply to each of the content areas.
The content is, to some extent, arbitrary. People made decisions about what to include and what to leave out. Another group of people in another time and place may well make different decisions.

The ability to think is the learning that lasts

Content is the raw material

Thinking is the process

Infusing Habits of Mind into the SOLs

Habits of Mind need to be taught explicitly and practiced continuously if they are to become habits.

- This does not have to be a ‘time’ problem because when you are practicing thinking you must be thinking about something.
- The ‘something’ is the content.

The language of thinking must be common currency and it must be a part of the culture – children need to hear the same language in all grade levels, in the hallways and at home

Habits of Mind in mathematics

Today we are going to be collecting data to build our graphs and then we will be interpreting that data and making some predictions.

Which Habits of Mind would serve us?

- Managing impulsivity
- Striving for accuracy
- Gathering data through all the senses

Habits of Mind in science

Today we are going to work in pairs to explain how electricity is generated by a changing magnetic field. We might want to create some diagrams to help us.

Which Habits of Mind would serve us?

- Thinking interdependently
- Listening with understanding and empathy
- Thinking and communicating with clarity and precision
- Applying past knowledge
**Habits of Mind (dispositions) vocabulary**
- You really persisted on that problem.
- I’ll give you some more time. I know you are metacogitating.
- We will be thinking interdependently as we do this task.
- We need to gather data through all our senses. Let’s review what those are.

**Thinking (skills) vocabulary**
- Let’s look at these two pictures
- How can you put these into groups?
- How do you know that’s true?
- How else could you use this?
- Let’s compare these two pictures
- How can you classify these?
- What evidence do you have?
- How could you apply this?

**In conclusion**
If we are to be successful educators we must:

**Be aware of our students’ preconceptions and prior knowledge**

**Turn novices into experts by teaching significant content (knowledge) within a conceptual framework that encourages transfer**

**Teach children how to consciously and skillfully think about what we teach them and how they learn - metacognition**
If we don’t respond to these three findings, see how far our errors propagate

preconceptions

What is TLC’s mission?

… to provide a way for educators to move beyond divisive arguments about testing and understand that the teaching of skillful thinking can be embedded in the curriculum and lead to improved student achievement.

All we need are enlightened systems that are flexible enough to encourage the teaching of thinking.

Please contact us

Thinking & Learning In Concert

… promoting the harmonious integration of skillful thinking and learning

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