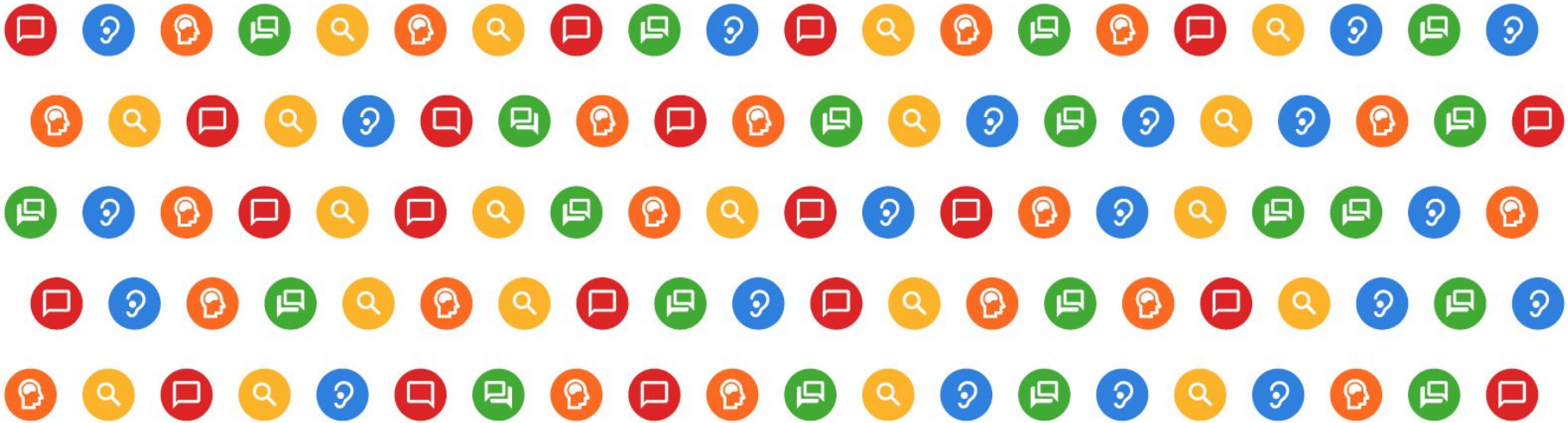
ThinkCERCA™

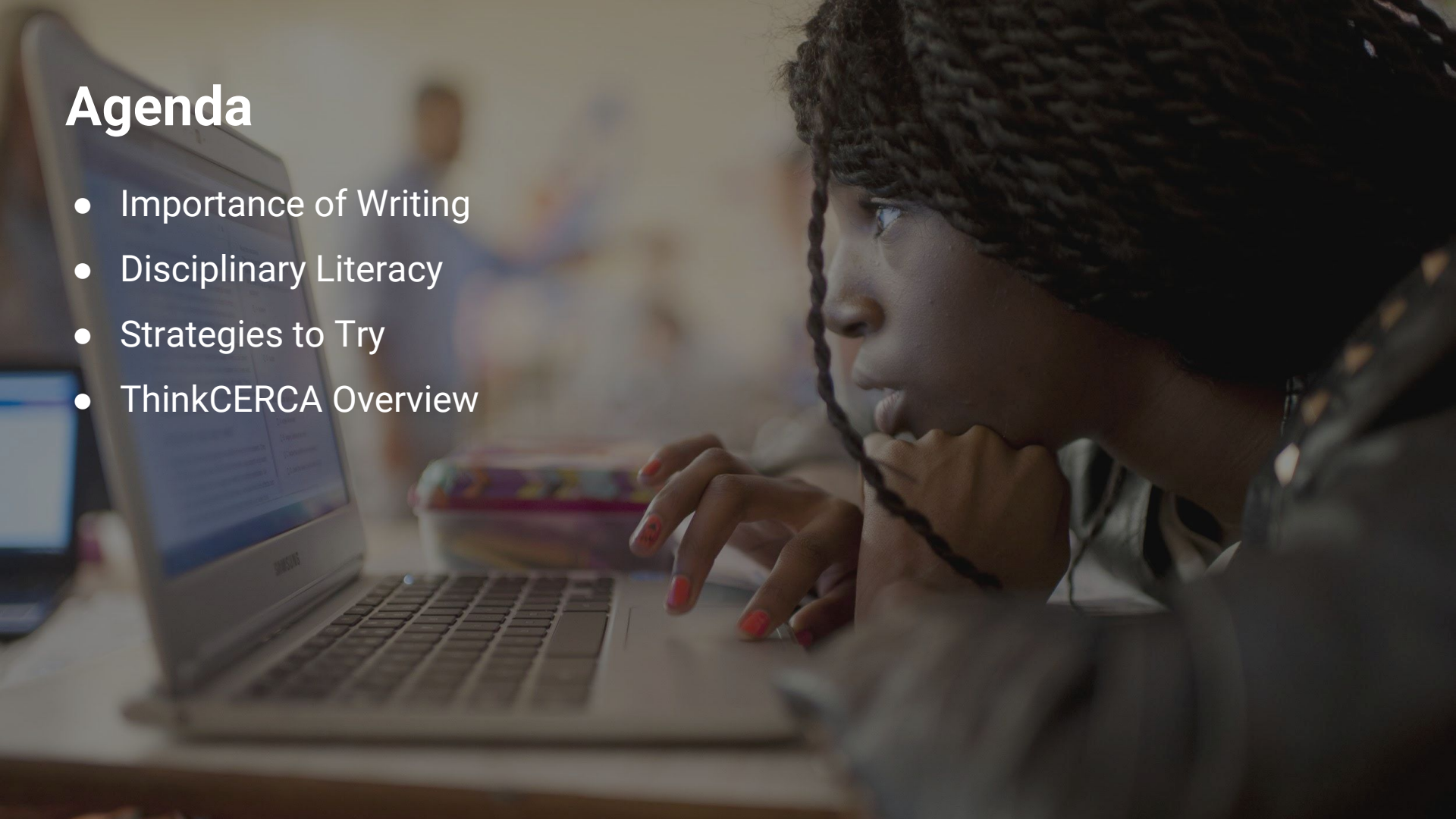
Writing in Math, Science, and Social Studies Subjects

Research and Strategies to Deepen Students' Learning



Agenda

- Importance of Writing
- Disciplinary Literacy
- Strategies to Try
- ThinkCERCA Overview



Why Does Writing Matter?

"The rising correlation between education and income is evidence of the **increasing literacy orientation of many workplaces**." (Shanahan and Shanahan, 2008)

Assessments Require More Robust Writing

21st Century Jobs Require:

OECD Policy Brief on the Future of Work: Automation and Independent Work in a Digital Economy, May 2016

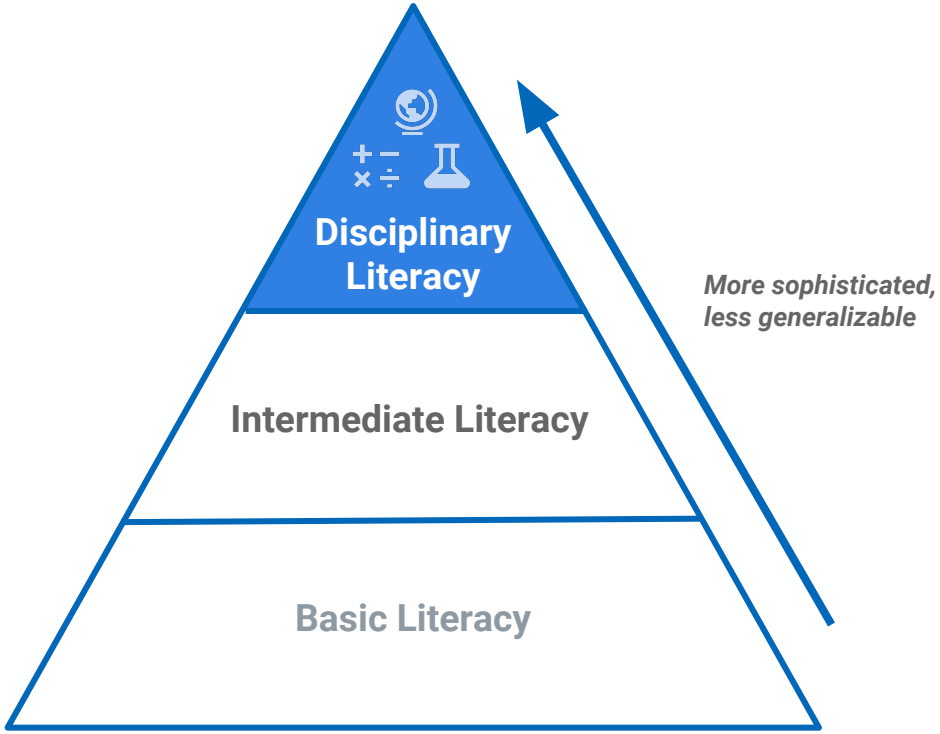
Why Does Writing Matter?

"Eventually we will send our students out into the wild, where newspapers of record, college courses, bosses and colleagues, and increasingly health care providers, bankers, and others **will not provide them with accessible texts**."

- (Murphy, 2016)

Literacy Development

While there are many ways to encourage your students to write more in the classroom (such as journals and quick-writes), remember that students need to engage in writing **in your discipline** on a regular basis.



(Shanahan & Shanahan, 2008)

Disciplinary Literacy

Content literacy emphasizes techniques that a novice might use to make sense of a disciplinary text...while disciplinary literacy emphasizes the **unique tools that the experts in a discipline use to participate in the work of that discipline**."

(Shanahan & Shanahan, 2012)

Disciplinary Literacy

“Disciplinary literacy is therefore defined as the confluence of:

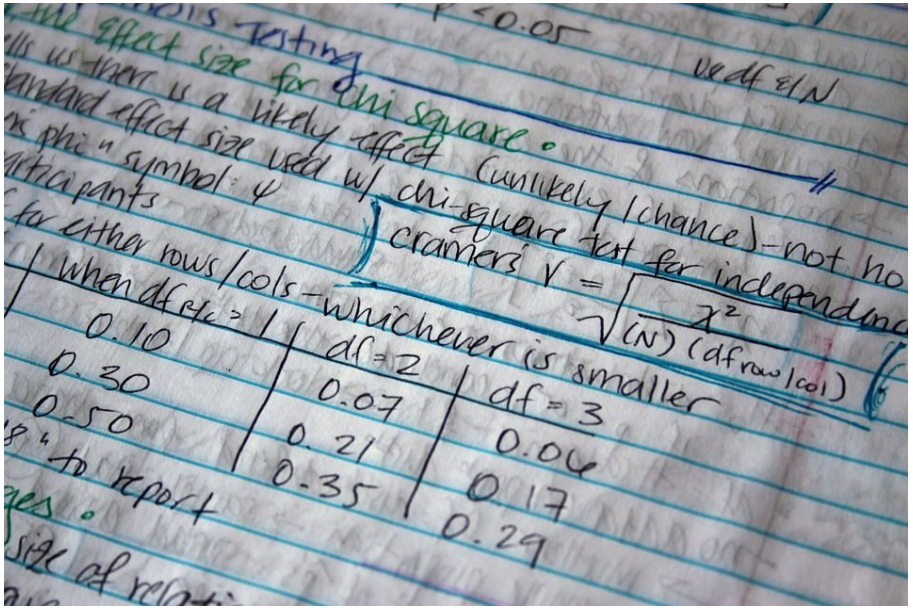
- Content knowledge
- Experiences and skills
- Ability to read, write, listen and speak
- “Thinking critically in a way that is meaningful within the content area” (Bickley, 2014)

Writing Like A Mathematician

Writing Like A Mathematician

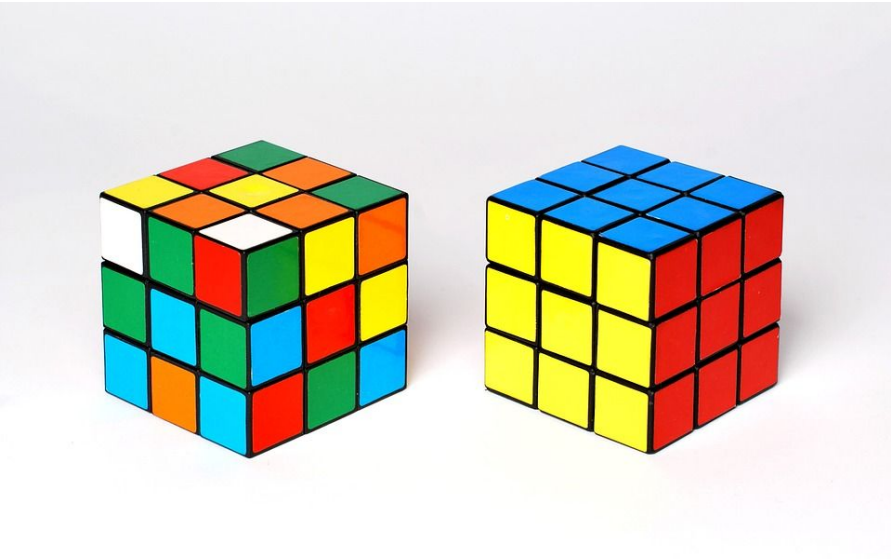
"Writing can provide opportunities for students to **construct their own knowledge** of mathematics."

- (Countryman, 1992, p vi–vii, emphasis mine).



Example from the Field

While students need to be able to solve problems, it is important that they understand **how a concrete problem is connected to an abstract concept.**



What language, skills, and concepts - specific to math - do you need to know to be successful answering this question?

$$n * (a+b)$$

What do n, a, and b mean?
What do they stand for?
What do they indicate?

$$n * (a+b)$$

How do I use the plus sign and multiplication sign?

What does the parentheses mean in this equation?
Where else do we use parentheses?

How do I connect the abstract to the concrete with this type of question?

Example from the Field

What this teacher did:

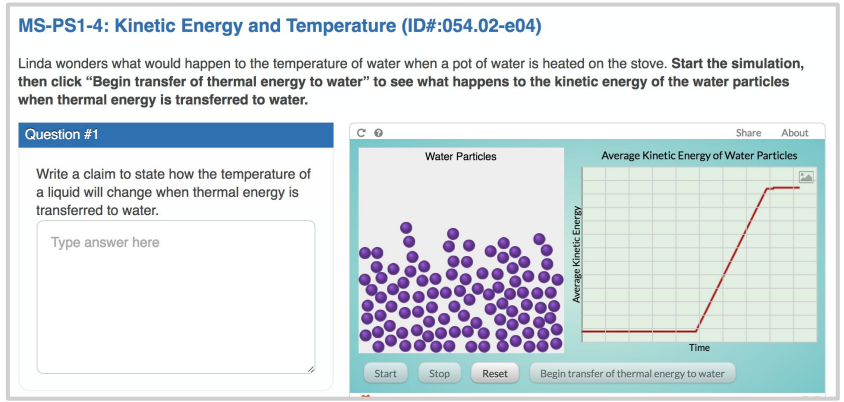
- ✓ Teaches vocabulary, concepts, and features of mathematics explicitly
- ✓ Compares purposes across disciplines
- ✓ Build relationships between concrete and abstract

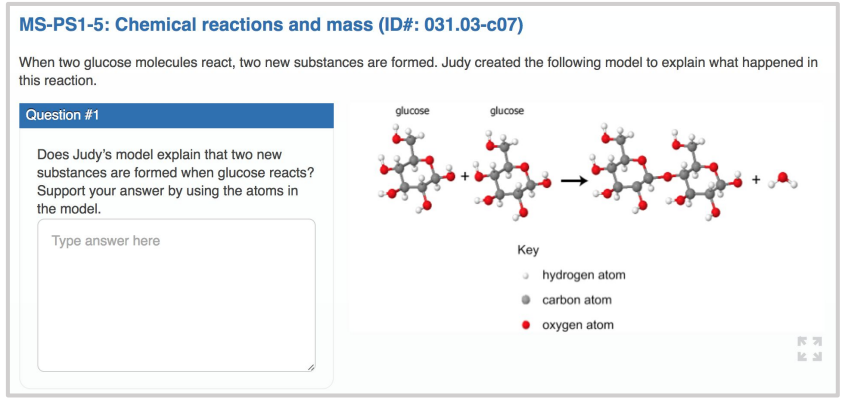
Writing Like A Scientist

Writing Like A Scientist

"Writing like a scientist requires a set of rules that are unique to science texts, such as use of **passive voice, noun phrases, nominalization of verbs, and language regarding confidence**."

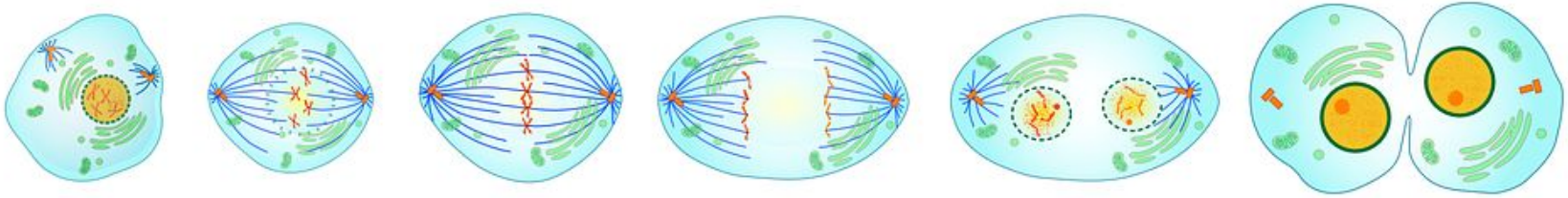
- (Fang & Schleppegrell, 2011)





Example from the Field

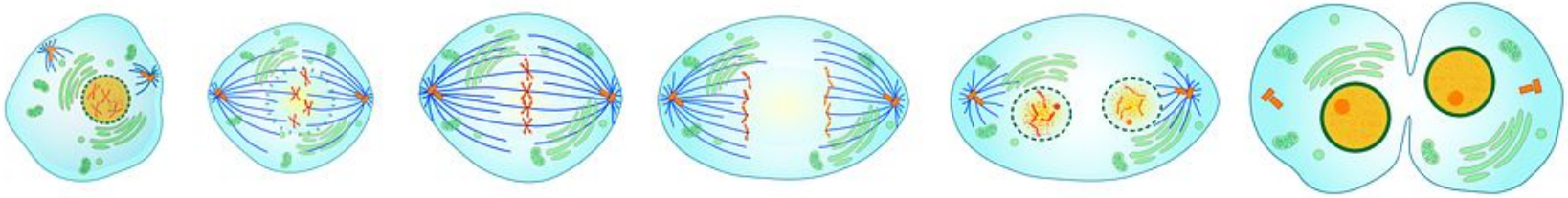
When my Science department and I planned out our curriculum, we noticed that the new NGSS standards did not focus on the traditional depth of knowledge into the concept of Mitosis.



Example from the Field

Students read and summarized differentiated texts to answer the argumentative question, **"To what extent do genes and the environment affect the development of cancer?"**

- Ava Javid, Science Educator, **Sequoia High School**



Example from the Field

What this teacher did:

- ✓ Expanded the lesson from a narrow focus on mitosis
- ✓ Connected to a larger topic that students could dig deeper into
- ✓ Provided a variety of resources
- ✓ Assigned a clear and concise task requiring use a variety of knowledge & science writing skills

Writing Like A Historian

Writing Like A Historian

"...[H]istorians **ask questions and review a variety of historical sources to make claims about the actors and events of the past**. In other words, they investigate and interpret the past by researching documents and artifacts—receipts, diaries, paintings, stories—in order to answer the questions they have."

- Annenberg Learner

Goals

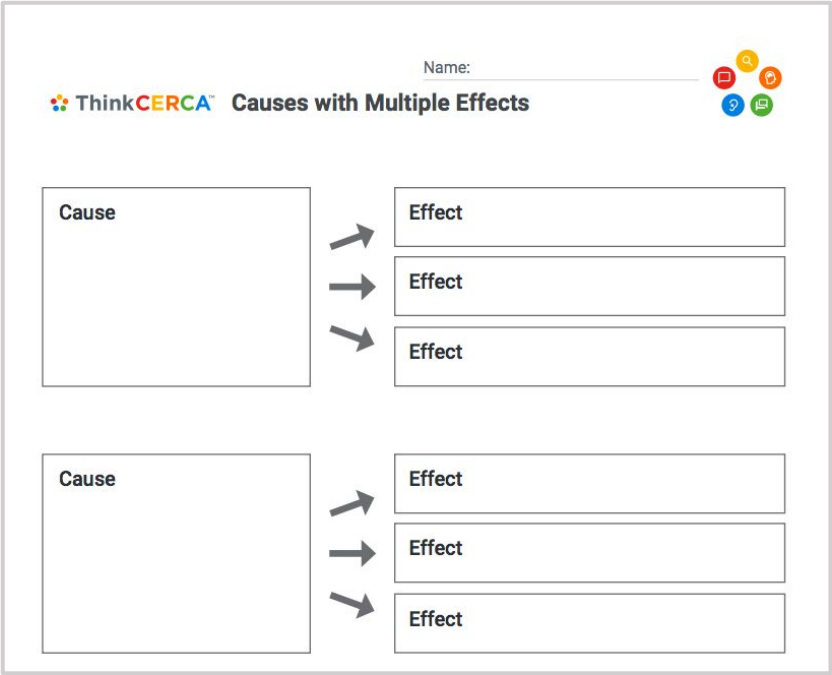
1. Teach content through the investigation of primary and secondary sources
2. Develop specific literacy practices in reading and writing that promote historical interpretation
3. Support analytical ways of thinking about the past

- Annenberg Learner

Example from the Field

*As a special education teacher, I am all about **differentiation and student choice**...we always have graphic organizers readily available for them to use as they see fit.*

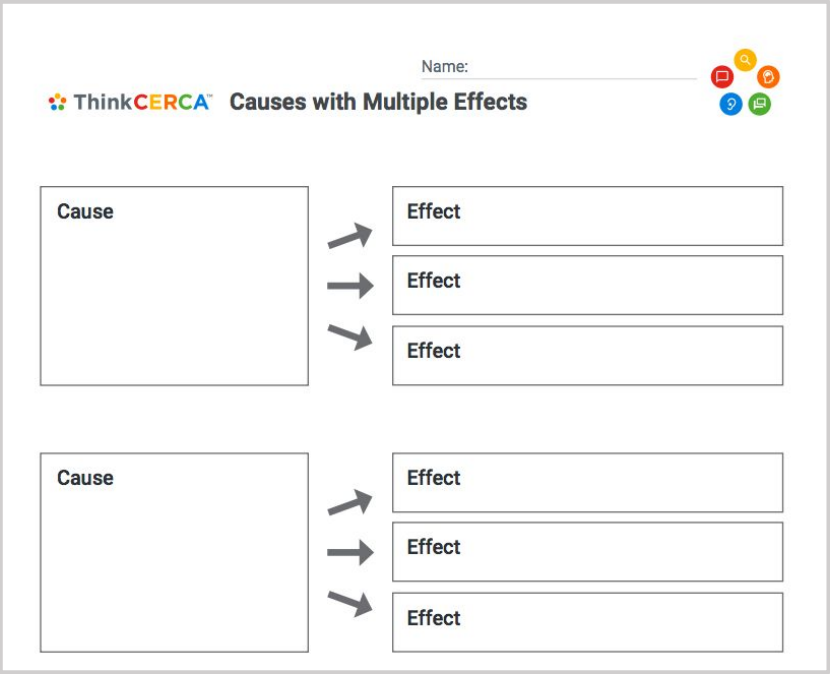
- Heather Fooden, 6th Grade Special Education ELA and Social Studies Teacher, **Corona Arts and Sciences Academy**



Example from the Field

What this teacher did:

- ✓ Provide a graphic organizer so students can appropriately include content into their writing
- ✓ Structure expectations that are appropriate for the field of the course
- ✓ High-level writing task



Strategies

Be clear with students about goals

- "Today, we are going to **wear our mathematicians hats** as we learn about fractions."

- "Historians are able to look at multiple primary sources and synthesize the content. As you read and analyze these sources, **begin thinking about how a historian would respond** in writing to the question…"

Strategies

Vocabulary Notebooks with Categories

PRIME	
GENERAL MEANING	**MATH MEANING**
"The best" or "main" Example: The prime reason I want to move to Hawai'i is the warm weather.	A number, greater than 1, that is evenly divisible by itself and 1 only Examples: 3, 5, 71 Non examples: 6, 40 (these are composite numbers)

Strategies

Writing for Purpose and Audience

Provide actual models for students in the discipline, so they can analyze the structure and develop an organizer to meet the expectations of the field.

NASA prepared this report outlining a plan for the International Space Station National Laboratory in response to direction in Section 507 of the NASA Authorization Act of 2005 (Public Law 109-155). The specific requirements of this plan are outlined below.

SEC. 507. NATIONAL LABORATORY DESIGNATION.

(a) DESIGNATION.—To further the policy described in section 501(a), the United States segment of the ISS is hereby designated a national laboratory.

(b) MANAGEMENT.—

(1) PARTNERSHIPS.—The Administrator shall seek to increase the utilization of the ISS by other Federal entities and the private sector through partnerships, cost-sharing agreements, and other arrangements that would supplement NASA funding of the ISS.

(2) CONTRACTING.—The Administrator may enter into a contract with a nongovernmental entity to operate the ISS national laboratory, subject to all applicable Federal laws and regulations.

(c) PLAN.—Not later than 1 year after the date of enactment of this Act, the Administrator shall transmit to the Committee on Science of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate a plan describing how the national laboratory will be operated. At a minimum, the plan shall describe—

(1) any changes in the research plan transmitted under section 506(3) and any other changes in the operation of the ISS resulting from the designation;

(2) any ground-based NASA operations or buildings that will be considered part of the national laboratory;

(3) the management structure for the laboratory, including the rationale for contracting or not contracting with a nongovernmental entity to operate the ISS national laboratory;

(4) the workforce that will be considered employees of the national laboratory;

(5) how NASA will seek the participation of other parties described in subsection (b)(1); and

manufactured—

(1) by the United States; or

(2) for the United States by other nations in exchange for funds or launch services.

2.0 INTRODUCTION

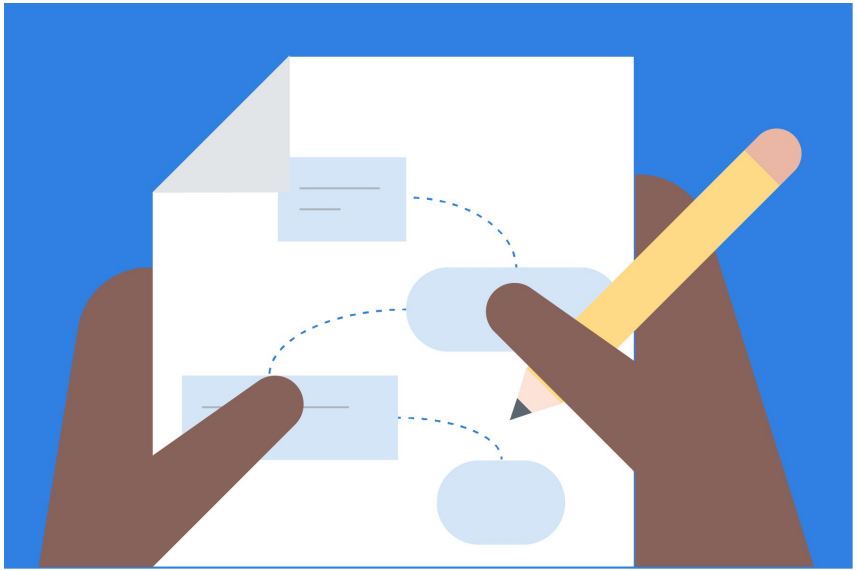
The International Space Station (ISS) constitutes a partnership among the nations of Canada, Europe, Japan, Russia and the United States (US) to cooperate on the design, development, operation and utilization of a permanently occupied civil space station. Assembly began with the first element launched in November 1998, and the ISS has been permanently crewed since November 2000. The on-orbit assembly, as of the STS-116 mission concluded December 22, 2006, is approximately 60% complete. All of the principal remaining US elements of the ISS, as well as the European and Japanese laboratories, have completed development, test and evaluation, and are awaiting launch at the Space Station Processing Facility, Kennedy Space Center.

In a major space policy address on January 14, 2004, President Bush directed NASA to focus its future human space exploration activities on a return to the Moon as prelude to future human missions to Mars and beyond. The NASA Authorization Act of 2005 (hereafter called the Act) also called for this renewed emphasis on space exploration. Included in this new national "Vision for Space Exploration" are plans to complete assembly of the ISS and retire the Space Shuttle fleet by the end of fiscal year (FY) 2010. In the second half of calendar year (CY) 2006, NASA demonstrated its commitment to achieve the FY 2010 objectives by successfully completing three Space Shuttle missions to the ISS. A $500 million NASA commitment also was made to partially finance demonstrations by 2010 of new US commercial orbital transportation services (COTS). These commercial services are planned to help support US maintenance and utilization of the ISS in the post-assembly era after the Space Shuttle is

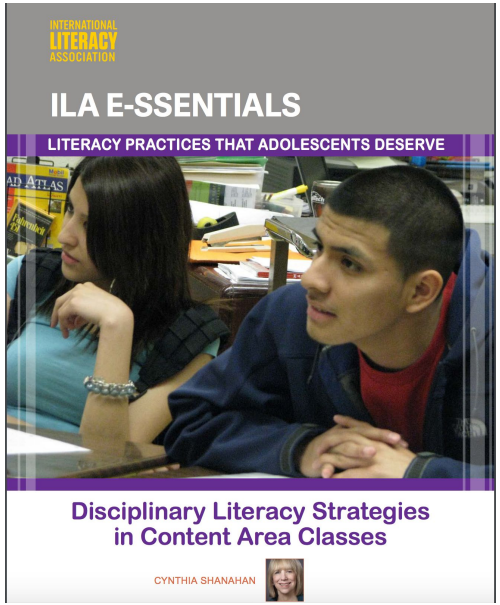
Strategies

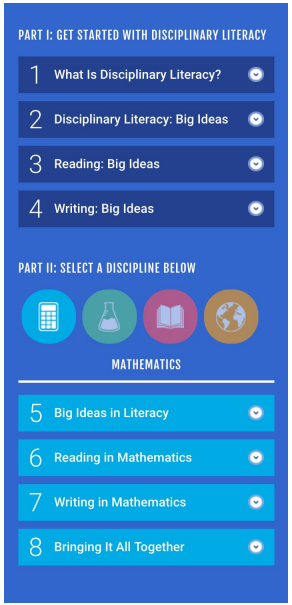
Use Diagrams

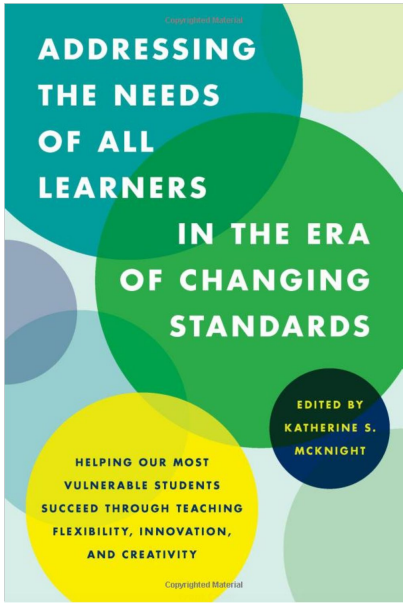
Use structures that allow students to analyze the relationships between events or concepts. **In history, for example, students may create a cause and effect graphic organizer** to map out a major event as well as the causes and sequences of other events related.

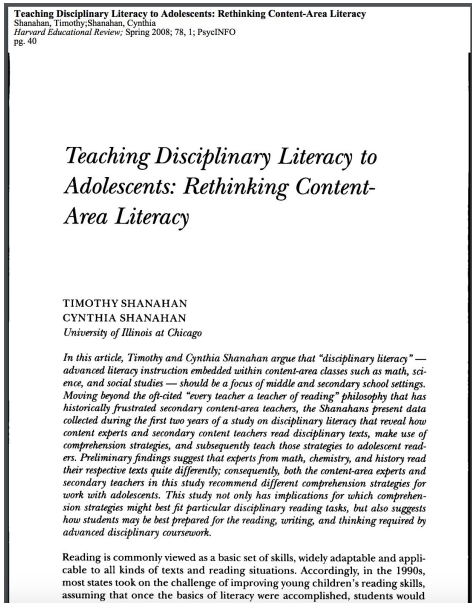


Want to learn more?









Teaching Disciplinary Literacy to Adolescents: Rethinking Content-Area Literacy
Shanahan, Timothy;Shanahan, Cynthia
Harvard Educational Review; Spring 2008; 78, 1; PsycINFO
pg. 40

Teaching Disciplinary Literacy to Adolescents: Rethinking Content-Area Literacy

TIMOTHY SHANAHAN
CYNTHIA SHANAHAN
University of Illinois at Chicago

In this article, Timothy and Cynthia Shanahan argue that "disciplinary literacy" — advanced literacy instruction embedded within content-area classes such as math, science, and social studies — should be a focus of middle and secondary school settings. Moving beyond the oft-cited "every teacher a teacher of reading" philosophy that has historically frustrated secondary content-area teachers, the Shanahans present data collected during the first two years of a study on disciplinary literacy that reveal how content experts and secondary content teachers read disciplinary texts, make use of comprehension strategies, and subsequently teach those strategies to adolescent readers. Preliminary findings suggest that experts from math, chemistry, and history read their respective texts quite differently; consequently, both the content-area experts and secondary teachers in this study recommend different comprehension strategies for work with adolescents. This study not only has implications for which comprehension strategies might best fit particular disciplinary reading tasks, but also suggests how students may be best prepared for the reading, writing, and thinking required by advanced disciplinary coursework.

Reading is commonly viewed as a basic set of skills, widely adaptable and applicable to all kinds of texts and reading situations. Accordingly, in the 1990s, most states took on the challenge of improving young children's reading skills, assuming that once the basics of literacy were accomplished, students would

one strategy you might try to encourage more discipline-specific w

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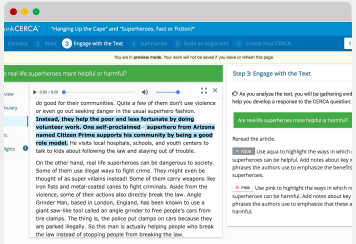
ThinkCERCA™

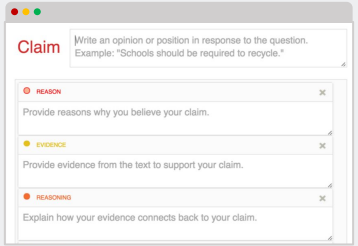
Teach critical thinking through argumentative writing

Personalized Literacy Platform for Grades 4-12



Read

- High-quality, authentic texts
- Differentiated lessons
- Close reading
- Standards alignment



Write

- Common Language: CERCA Framework
- Scaffolded writing process
- Argumentative writing
- Narrative and informational writing

Grow

- CERCA three times per month
- Students engaged in higher-order thinking
- More time with students
- Improved teacher effectiveness

Grades 4 - 12 • English Language Arts • Science • Social Studies • Math

1.5 - 2.5 years of growth in a single year

Third-Party Verified