Preparing Secondary Science Teachers To Teach English Learners

NSF DRL Program Award
#: 1316834

Presented at the Arizona Science Teachers Association (ASTA) Conference

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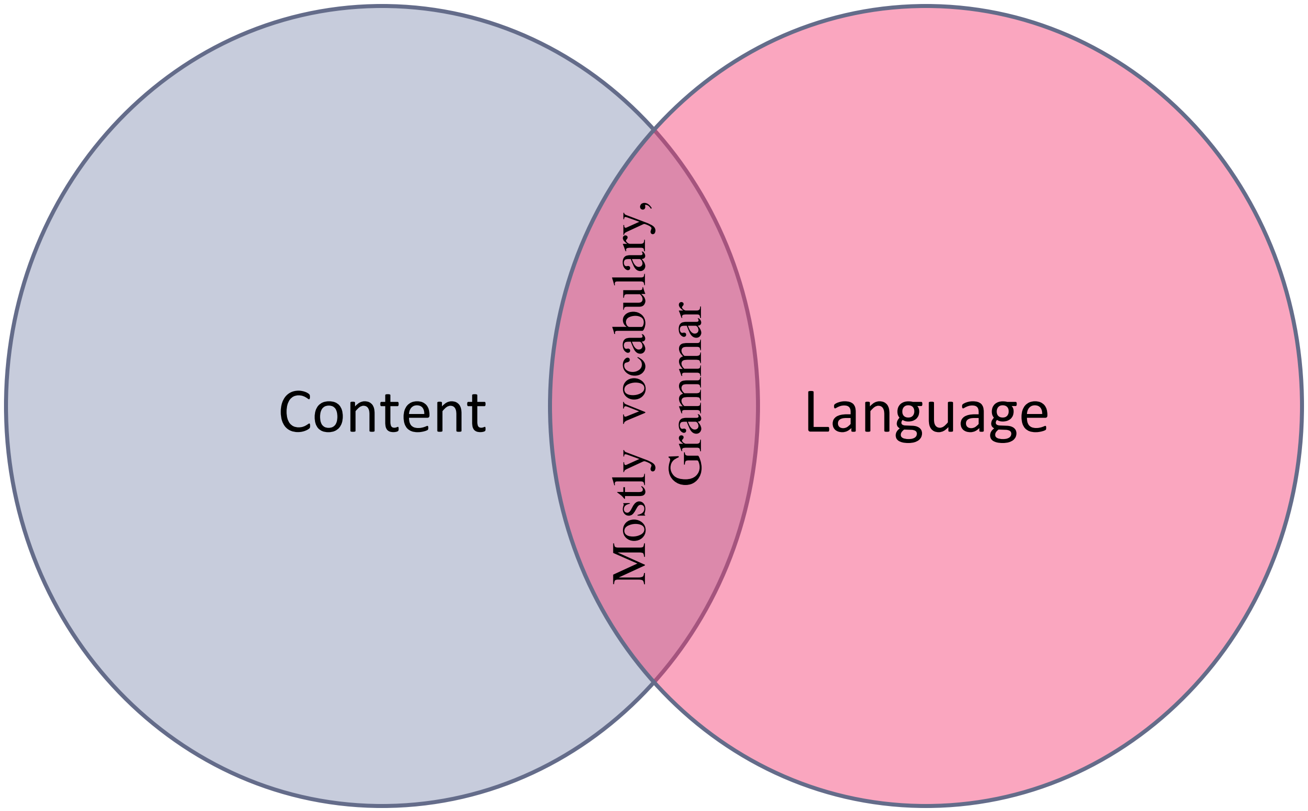
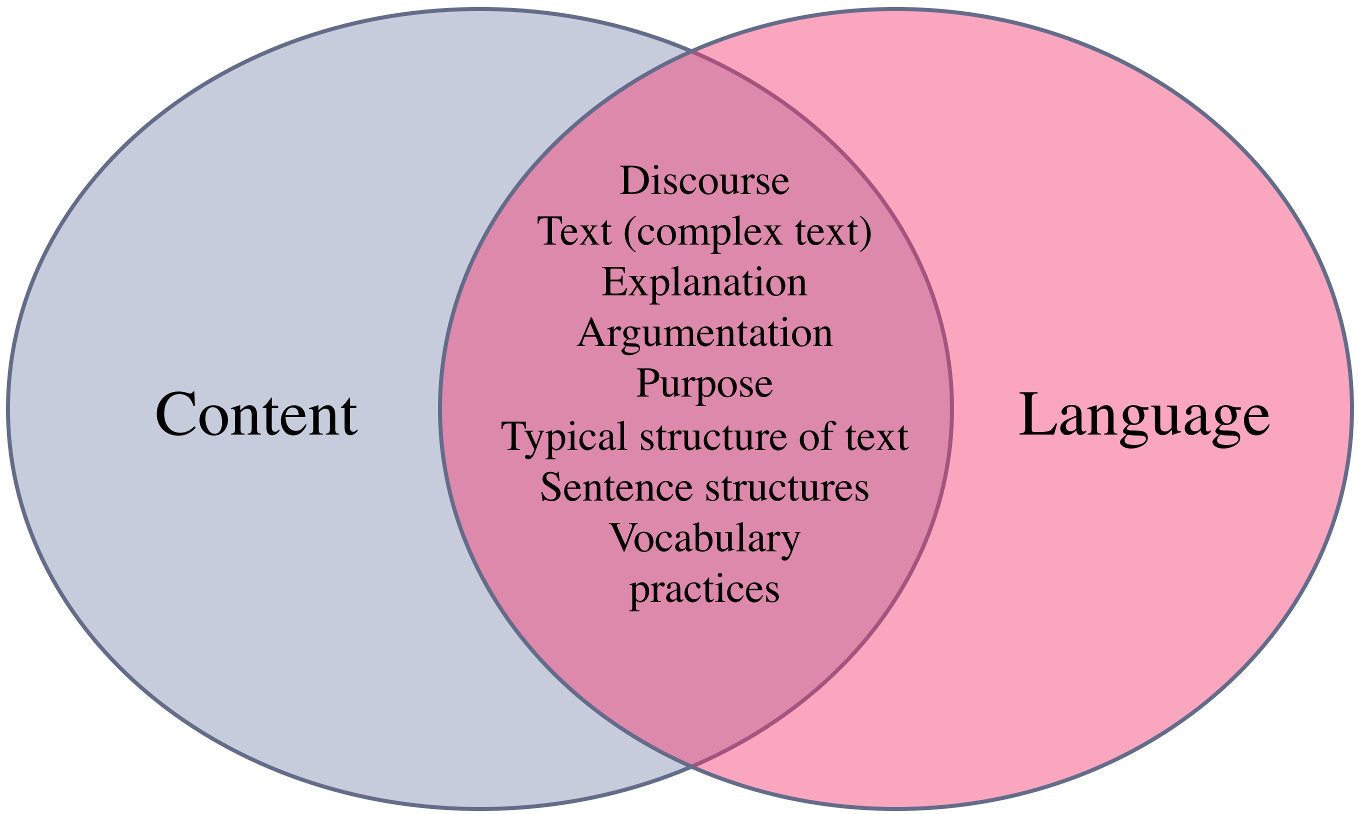
Friday, November 7, 2014
11:45a – 1:55p in Room 150

Old Paradigm



Slide courtesy of Kenji Hakuta, Understanding Language Project, Stanford University

New Paradigm



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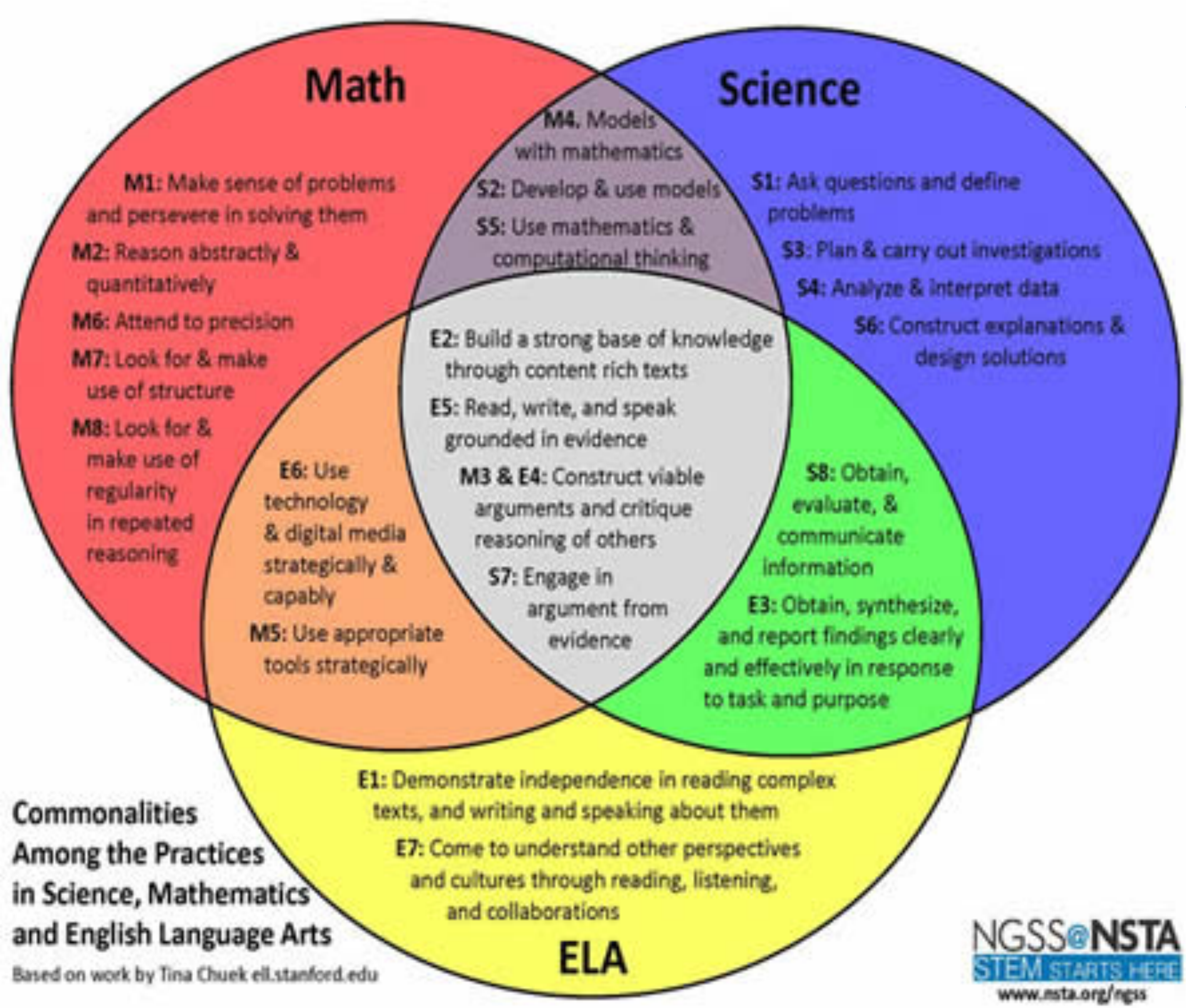

Math
Science
M4. Models with mathematics
S2: Develop & use models
S5: Use mathematics & computational thinking
M1: Make sense of problems and persevere in solving them
M2: Reason abstractly & quantitatively
M6: Attend to precision
M7: Look for & make use of structure
M8: Look for & make use of regularity in repeated reasoning
S1: Ask questions and define problems
S3: Plan & carry out investigations
S4: Analyze & interpret data
S6: Construct explanations & design solutions
E2: Build a strong base of knowledge through content rich texts
E5: Read, write, and speak grounded in evidence
M3 & E4: Construct viable arguments and critique reasoning of others
S7: Engage in argument from evidence
E6: Use technology & digital media strategically & capably
M5: Use appropriate tools strategically
S8: Obtain, evaluate, & communicate information
E3: Obtain, synthesize, and report findings clearly and effectively in response to task and purpose
E1: Demonstrate independence in reading complex texts, and writing and speaking about them
E7: Come to understand other perspectives and cultures through reading, listening, and collaborations
ELA
Commonalities Among the Practices in Science, Mathematics and English Language Arts
Based on work by Tina Chuek ell.stanford.edu
NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss

Workshop Agenda and Goals

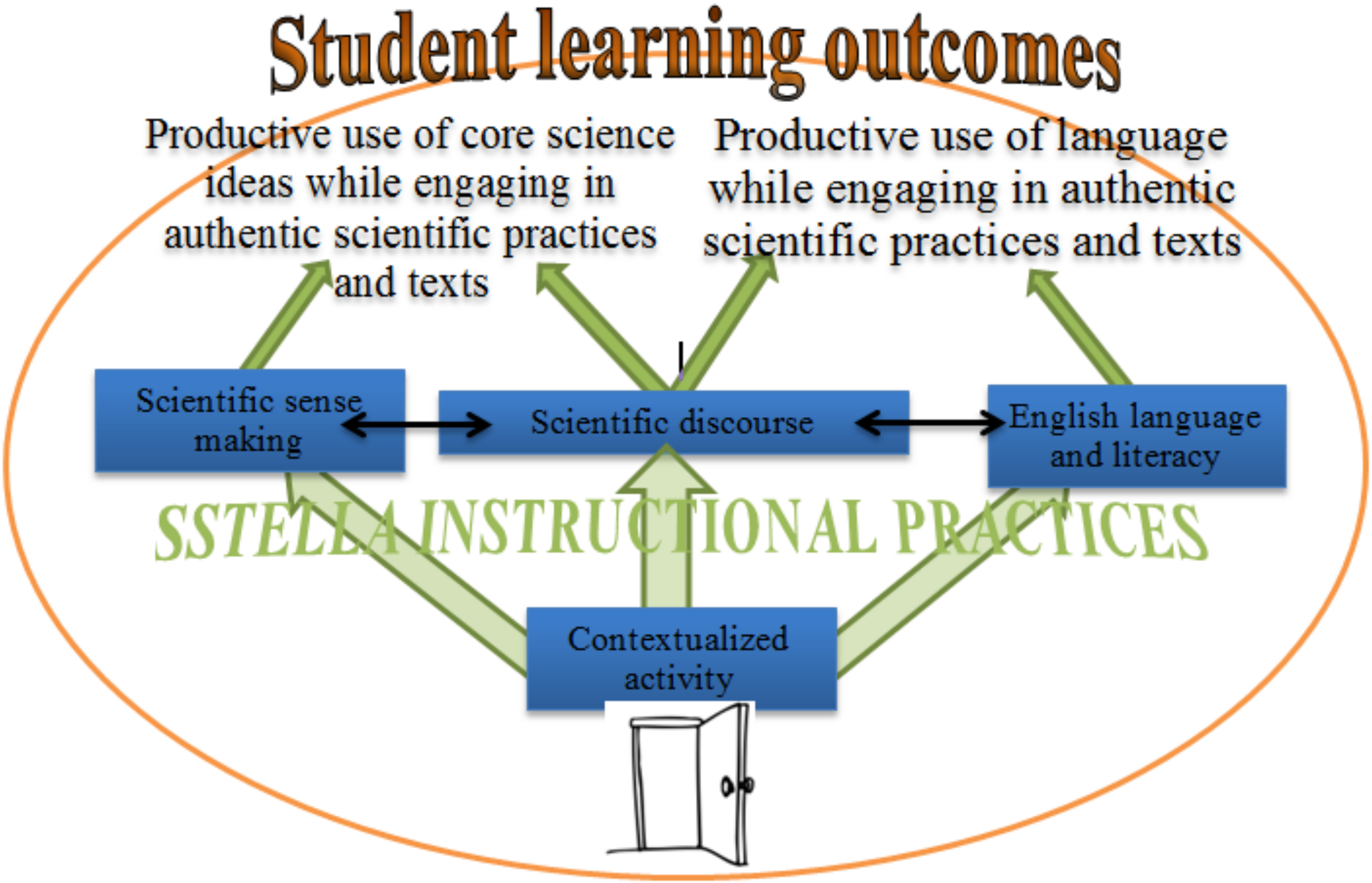
AGENDA

- Introduce the SSTELLA Framework (11:45-12)
- Model lesson: Antibiotic Resistance of MRSA (12-12:45)
- BREAK (12:45-12:55)
- Deconstruct MRSA Lesson (12:55-1:40)
- Closing remarks and questions (1:40-1:55)

GOAL

- Exposure to key teaching practices shown to improve ELs' ***science learning and English language development***
- Experience a science lesson that INTEGRATES language, literacy, and science
- Identify features of the lesson that support science learning and language development

Secondary Science Teaching with English Language and Literacy Acquisition (SSTELLA)



Contextualized Activity

SSTELLA promotes…

- FRAMING activities in a context RELEVANT to your students and AUTHENTIC to local/ global issues

- Eliciting and leveraging students' LIVED EXPERIENCES for deeper science learning

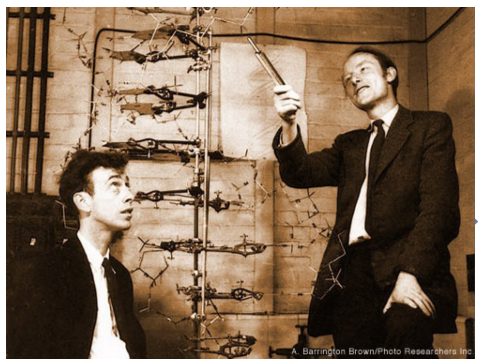
Instead of…

- Activities WITHOUT a RELEVANT context (or a context just relevant to the teacher)
- IGNORNING students' LIVED EXPERIENCES

Scientific Sense-making

SSTELLA promotes…

- BIG IDEAS in science and CLEAR EXPECTATIONS for learning
- Student engagement in scientific/ engineering practices (with an emphasis on MODELING) to make sense of big ideas with sustained SUPPORTS



Instead of…

- Disjointed science "topics" and vague learning expectations
- Students just receiving factual information or just carrying out pre-planned investigations

Scientific Discourse

SSTELLA promotes…

- Engaging students in talk to share and expand on science ideas with other students and participate in the discourse of science (e.g., use evidence while explaining and arguing)

Instead of…

- Engaging students in talk that merely answers closed ended questions

English Language and Disciplinary-Literacy Development

SSTELLA promotes…

- ELD as USING language to makes sense of science
  - Support ELs in widespread student interaction
  - Support ELs in using vocabulary when DOING science
  - Support ELs in DISCIPLINE specific reading/writing while attending to audience/purpose

Instead of…

- ELD as fluency, knowing vocabulary, general reading comprehension
  - Little student interaction
  - Developing vocabulary through definitions without connecting it to understanding/doing science
  - Reading/writing focused on general comprehension and conventions

Explaining the Antibiotic Resistance of *Staphylococcus aureus* (or MRSA)

LESSON OVERVIEW

- **Arizona Science Standard**: *Explain how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment.*
- **NGSS**: *Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.*
- **Arizona College and Career Readiness Standard**: *Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes*

Anticipatory Question

- **Think about a current or past experience with hospitals (Injury? Birth of a sibling or relative? Family member illness?)**

Based on these experiences, and what you know about hospitals, would someone ***be likely*** to get an infection (from bacteria) WHILE staying in a local hospital?

Write your response **with evidence** in your science notebook

FACTOR	KEY POINTS (WORDS AND PICTURES)	ASSOCIATED IN-CLASS ACTIVITY
1. Population growth the potential for a species to increase in number		Fish simulation
2. Heritable traits the heritable genetic variation of individuals in a species due to mutation and sexual reproduction		Sunflower seed activity: We picked a seed from a bowl, examined it closely, return it to the bowl, and tried to find it again. We discuss general observations of variation in living things
3. Competition Competition for limited resources		Game "Oh Deer": Outdoor simulation where we pretended to be either a deer or a resource (water, food, shelter). Deer must procure resources to survive, competing against their classmates who are also deer.
4. Survival of the fitter the proliferation (continued survival) of those organisms that are better able to survive and reproduce in the environment.		Wormeater Game and group discussion: We were given a utensil and have to "hunt" for worms (rubber bands). Survivors reproduce.

Learning objective: Use Darwin's theory of natural selection to explain how some bacterial strains (variations) become resistant to antibiotics

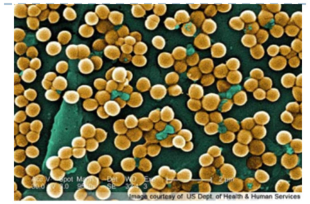
It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.

MRSA [pronounced MERSA] : An example of antibiotic resistance

https://www.youtube.com/watch?v=bevhCDOoYeE

Stop at 1:14

MRSA [pronounced MERSA] : An example of antibiotic resistance



- What is the species of interest?

- What is an antibiotic?

- What does it mean to be RESISTANT to antibiotics?
- What is MRSA in relation to the species: ___________
- Why is MRSA of concern (especially in hospitals)?

Reading Roles (for Artifact B-1 and B-2)

1. Reader (read the text aloud) – checks group for any unknown words/concepts
2. Claim finder (identify and summarize the claim or main idea of the text)
3. Evidence finder (identify list any evidence of support of the claim)
4. Audience finder (predicts who the audience of this text might be – with evidence!)

Why is MRSA a concern?

Problems occur if *Staphyloccocus aureus* bacteria are able to enter the body through a cut or wound. Most healthy people have strong immune systems and are able to fight off a *Staphylococcus aureus* infection themselves and have only mild symptoms. However, people with weakened immune systems (for example due to other illnesses) or who have undergone surgery (for example heart surgery or hip replacement) can develop more serious problems. In more vulnerable people, *Staphyloccocus aureus* bacteria have been known to cause boils, abscesses, septic wounds, heart-valve problems and toxic shock syndrome. In extreme cases, it can result in death. People with weakened immune systems who have been infected with *Staphylococcus aureus* require treatment with antibiotics to help clear the infection.

New answer to MRSA, other 'superbug' infections: clay minerals?

Researchers discover natural clay deposits with antibacterial properties

Are the best medicines hidden in the Earth? French green clays are used for healing Buruli ulcers.
Credit and Larger Version

Superbugs, they're called: Pathogens, or disease-causing microorganisms, resistant to multiple antibiotics.

Such antibiotic resistance is now a major public health concern.

"This serious threat is no longer a prediction for the future," states a 2014 World Health Organization report, "it's happening right now in every region of the world and has the potential to affect anyone, of any age, in any country."

Could the answer to this threat be hidden in clays formed in minerals deep in the Earth?

Biomedicine meets geochemistry

"As antibiotic-resistant bacterial strains emerge and pose increasing health risks," says Lynda Williams, a biogeochemist at Arizona State University (ASU), "new antibacterial agents are urgently needed."

To find answers, Williams and colleague Keith Morrison of ASU set out to identify naturally-occurring antibacterial clays effective at killing antibiotic-resistant bacteria.

The scientists headed to the field--the rock field. In a volcanic deposit near Crater Lake, Oregon, they hit pay dirt.

Back in the lab, the researchers incubated the pathogens *Escherichia coli* and *Staphylococcus epidermidis,* which breeds skin infections, with clays from different zones of the Oregon deposit.

They found that the clays' rapid uptake of iron impaired bacterial metabolism. Cells were flooded with excess iron, which overwhelmed iron storage proteins and killed the bacteria.

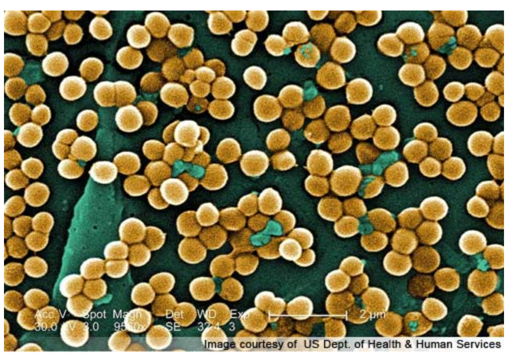
"The ability of antibacterial clays to buffer pH also appears key to their healing potential and viability as alternatives to conventional antibiotics," state the scientists in a paper recently published in the journal *Environmental Geochemistry and Health*.

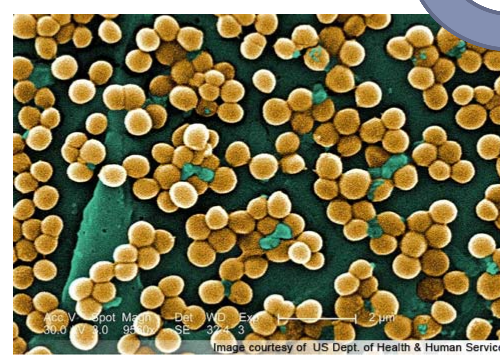
"Minerals have long had a role in non-traditional medicine," says Enriqueta Barrera, a program director in the National Science Foundation's (NSF) Division of Earth Sciences, which funded the research.

"Yet there is often no understanding of the reaction between the minerals and the human body or agents that cause illness. This research explains the mechanism by which clay minerals interfere with the functioning of pathogenic bacteria. The results have the potential to lead to the wide use of clays in the pharmaceutical industry."

	Why is MRSA a Concern?	New Answers to MRSA
Claim		
Evidence		
Reasoning		
Audience		

“How did the species *Staphylococcus aureus change over time so that, currently, over 60% are resistant to the antibiotic* methicillin”





How long ago did Methicillin-Resistant *Staphylococcus aureus* (MRSA) develop?

The timeline over which MRSA emerged is as follows:[1]

- ***Late 1880s***:
  Scottish surgeon Alexander Ogston identifies a bacterium, *Staphylococcus aureus*
- ***1928***:
  British scientist Alexander Fleming discovers the first antibiotic, penicillin
- ***1941***:
  Penicillin becomes available in the U.S. and England. The first penicillin-resistant *S. aureus* is reported a short time later
- ***Late 1940s***:
  25 percent of *S. aureus* bacteria in hospitals are penicillin-resistant
- ***1958***:
  Vancomycin is introduced and is still considered to be the antibiotic of last resort today
- ***1959***:
  The antibiotic, methicillin, is introduced
- ***1961***:
  Doctors find the first cases of MRSA
- ***2002***:
  Doctors first identify vancomycin-resistant *S. aureus* (VRSA) in the U.S. (Michigan[2] and Pennsylvania[3])
- ***Today***:
  Over 95 percent of *S. aureus* worldwide is penicillin-resistant and 60 percent is methicillin-resistant

Explanation Storyboard

	BEFORE 1941	BETWEEN 1941 AND 2013	CURRENTLY
VISUAL			
WHAT IS HAPPENING? (% of resistant *S. aureus*)			
EVIDENCE? (use timeline and other info)			
WHY? (use one or more influential factors)			

What would happen next?

- Peer feedback and revision of explanation storyboard
- Discuss elements of a "written" explanation
- Write, share, and revise written explanation
- Reciprocal reading of additional information
- Explain MRSA to a difference audience (local day care) for culminating assessment

10 MINUTE BREAK!

DECONSTRUCTING THE MRSA LESSON

CLOSING REMARKS AND QUESTIONS

- English Learners are being supported when…
  - Science learning is CONTEXTUALIZED
  - Students have opportunities to engage in the practices and discourse of scientists/engineers
  - Language and literacy supports are in the service of DOING science
  - *Promoting NGSS and ACCRS allows for deeper science learning and language development for ELs*
- English Learners are NOT being supported when..
  - Science learning is decontextualized and factual,
  - Language supports focus on fluency, grammar, basic reading comprehension, and knowing vocabulary