



The 4Cs of Mathematics Instruction

Collaborate, Create, Communicate, Critique

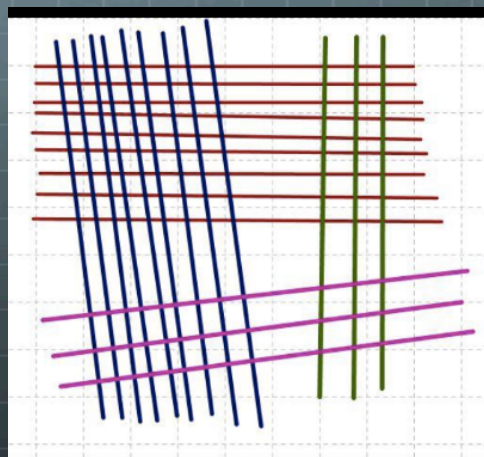
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A Mathematical Task

With the people at your table, use the image at the right to determine the value of 82^2 .

Be prepared to share your explanation with another group.

Extend it determine 93^2 .



In our time together today...

- 🌐 Identify a framework through which we can analyze our classroom practices.
- 🌐 Collectively define collaboration, creativity, communication, and critical thinking.
- 🌐 Apply our definitions to classroom tasks and scenarios to identify areas of strength and areas for continued growth.

What is LEARNING?

- 🌐 *"I learned that yesterday!"*
- 🌐 *"I learned that when I was in school but do not remember."*
- 🌐 *"Did we learn anything when I was absent yesterday?"*

What is LEARNING?

Think for a moment...

- 🌐 What *is* learning?
- 🌐 What conditions are necessary for learning to occur?
- 🌐 What evidence is necessary to confidently state that learning *has* occurred?

One Look at Learning...



Did Penny Learn?

- 🌐 Using the conditions you identified prior to the clip, discuss with your neighbor whether Penny *learned*.
- 🌐 Identify what she *learned*.
- 🌐 Identify the evidence you saw for her *learning*, or the evidence you would like to see.

A Closer Look at Learning

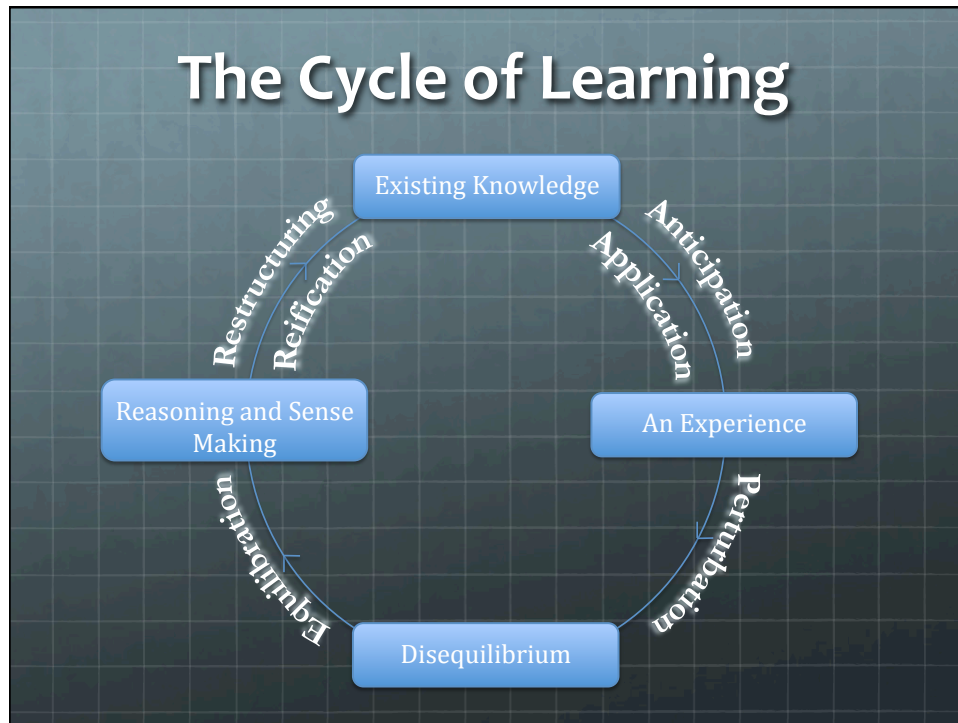
Reflect on a time when you experienced authentic learning...

What did you learn?

What did you go through in order to learn?

Where were you?

Why do you remember it so well?



With a partner

- 🌐 Re-visit your learning experience.
- 🌐 From what you can recall, narrate your learning experience for your partner identifying the parts of the learning process from the learning cycle.

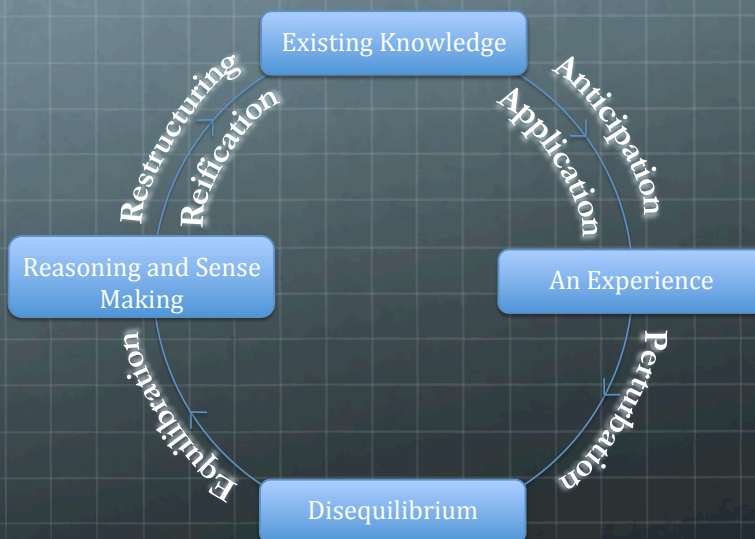
Teaching as the Induction of Learning

Our task each and every <time period> is to design instruction that artfully and skillfully allows this process to unfold for our students...

while paying attention to a variety of factors,

e.g., readiness for learning,
 social and emotional skills,
 depth of learning,
 intervention,
 varied pace of learning. and
 established targets.

The Cycle of Learning



Experiencing Learning

- 🌐 For this next activity, the goal is to have you participate in a learning experience while simultaneously attending to your own progress through the learning process.
- 🌐 Each time your experience produces disequilibrium, state such to your partner.
- 🌐 Each time that reasoning and sense-making produce something that you now take as learning, state it aloud to your partner.

Take the Last One

In this mathematical “game” for pairs, each person in the duo chooses a positive whole number initially unknown to the other. At the signal, each member reveals the number to the other simultaneously. Let the chosen numbers each represent a quantity of objects to be taken, starting with the person who wrote down the larger number, players take turns removing any number of “objects” from either set.

A person “wins” the game if they force the other person to take the final object.

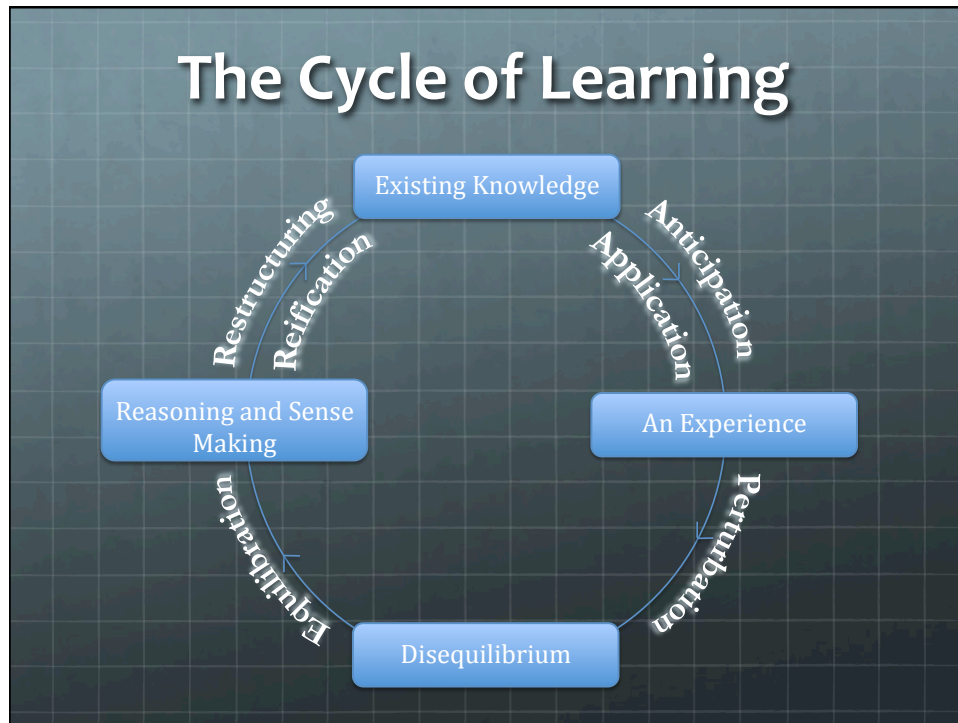
For example

- For example:
- Player 1: 12 and Player 2: 18
- Start (12, 18)
- Player 2 goes first. Takes 3 from the 12: (9, 18)
- Player 1 takes 5 from the 18: (9, 13)
- Player 2 takes 8 from the 9: (1, 13)
- Player 1 takes 13 from the 13: (1, 0)
- Player 2 must take the 1 and loses.
- Task: Develop a strategy that will guarantee a win.

Take the Last One

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Career and College Readiness



- 🌐 Collaboration
 - 🌐 Creativity
 - 🌐 Communication
 - 🌐 Critical Thinking
- 🌐 Where in the learning process do these get taught?

A Short Reading

 Go to: <http://www.tinyurl.com/CCCCASCD>

At your Tables

 Using your table's assigned "21st-century" skill:

-  Define the skill
-  Develop a list of executable actions that we must teach students in order to best be able to acquire the skill

Using your list

- Watch the following clip:
- <http://www.learner.org/resources/series34.html?pop=yes&pid=926>
- Use your 21st-century skill as a lens. Analyze your list and edit it as necessary.

Group Share

Compare and Contrast

4Cs

-  Collaborate
-  Create
-  Communicate
-  Critique

Your turn

- 🌐 For the following problem, appoint one person to observe your work for each of the 4Cs and the learning cycle
- 🌐 The remaining people will complete the following task.

The Problem...

As a group, solve the following problem in at least two different ways. Compare and contrast your two solutions.

Three friends went on a fishing trip. After spending the day catching fish, all three agreed to split the catch in the morning and turned in for the night. One of the fisherman woke up in the middle of the night and decided to take his share. He divided the fish into 3 groups. There was one fish left over so he threw it back in the lake. He took his third and left the remaining fish in the tub.

The other two fishermen did exactly the same thing!

When they woke up in the morning, the friends took the fish in the tub and divided it into three equal groups. There was one left over so they threw it back in the lake.

What is the smallest number of fish they could have caught?

Dimensions and Core Features

DIMENSIONS

Nature of Classroom Tasks

Role of the Teacher

Social Culture of the Classroom

Mathematical Tools as Learning Supports

Equity and Accessibility

CORE FEATURES

Make mathematics problematic
Connect with where students are
Leave behind something of mathematical value

Select tasks with goals in mind
Share essential information
Establish classroom culture

Ideas and methods are valued
Students choose and share their methods
Mistakes are learning sites for everyone
Correctness resides in mathematical argument

Meaning for tools must be constructed by each user
Used with purpose--to solve problems
Used for recording, communicating, and thinking

Tasks are accessible to all students
Every student is heard
Every student contributes

Task-based instruction

- 🌐 Make mathematics problematic
- 🌐 Connect with where students are
- 🌐 Leave behind something of mathematical value
- 🌐 Tasks determine the level of thinking in the classroom

Collaborative Classroom Settings

- Students are taught to collaborate
- Tasks require students to work together
- Physical arrangement of classroom communicates the priority of collaboration
- Student-to-student communication is monitored and feedback provided
- Student work as a team is valued, honored, and used to support learning

The Standards for *Mathematical Practice*

1. Makes sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Teaching Mathematics for Understanding

Requires that We Engage in Lesson Planning from the Students' Point of View

Planning from the SPOV

- Introduction and Learning Target
 - What will I be expected to do that the beginning of the class period? At what cognitive level will I have to engage? What activities will I be doing?
 - How will my teacher know I am ready for today's lesson? How will I know?
 - How will the opening activity be connected to what I did yesterday or last night? How will it provide me with feedback on where I stand?

Planning from the SPOV

- 🌐 Lesson Context: Connecting the Target to an Objective
 - 🌐 How or why is this particular lesson important to me?
How will I know?
 - 🌐 Which of the mathematical practices will I be focusing on in this lesson?
 - 🌐 How will I connect the mathematical skill to the mathematical concept?
 - 🌐 How will I demonstrate my learning so that I know my teacher sees it as the lesson unfolds?

Planning from the SPOV

- 🌐 Lesson Process: Student Engagement
 - 🌐 Do I understand the tasks that I am being asked to complete?
 - 🌐 Am I on the lookout for my daily “Aha” moment where I make connections among concepts?
 - 🌐 How will technology help me visualize concepts?

Planning from the SPOV

- Lesson Process: Student Engagement
 - How will I demonstrate that I can reason, conjecture, and create viable arguments?
 - What higher order questions am I seeking to answer?
 - How will my teacher support my work with peers?
 - If I struggle, how will I get support?

Planning from the SPOV

- Lesson Closure
 - How will I summarize the lesson and my learning for today?
 - How will I know if I have reached the target?
 - What do I need to do to close the gap between what is expected of me and what I have learned?

Thoughts on Instruction

- Lessons that develop mathematical practices prepare students for long-term learning of mathematics.
- High levels of mathematics learning for ALL requires:
 - Establishing learning goals
 - Implementing challenging tasks
 - Connecting and using representations
 - Posing purposeful questions
 - Facilitating meaningful discourse
 - Building procedural fluency from conceptual understanding
 - Supporting productive struggle
 - Eliciting and using evidence of learning

In our time together today...

- Identify a framework through which we can analyze our classroom practices.
- Collectively define collaboration, creativity, communication, and critical thinking.
- Apply our definitions to classroom tasks and scenarios to identify areas of strength and areas for continued growth.

Conclusions

- 🌐 Changing to a focus on learning requires an agreed-upon definition of learning.
- 🌐 Teaching students to be collaborators, creators, communicators, and critical thinkers requires focused instruction as well.

Thank you!