

# The Argumentation Process: Getting all Students Engaged in Science Discourse



David Mwangi

Erika Cooke

East Orange School District

[d.mwangi@eastorange.k12.nj.us](mailto:d.mwangi@eastorange.k12.nj.us)

# The Need for Equity in Science

All students can learn complex science

Achievement gap results from

- Inequities in opportunities to learn science
- Failure to leverage existing competencies

Diversity of perspectives leads to more rigorous learning

# Argumentation Enhances Equity

Closes performance gaps (Ocar, 2015)

Makes instruction inclusive and motivating for diverse groups

Provides multiple opportunities for support

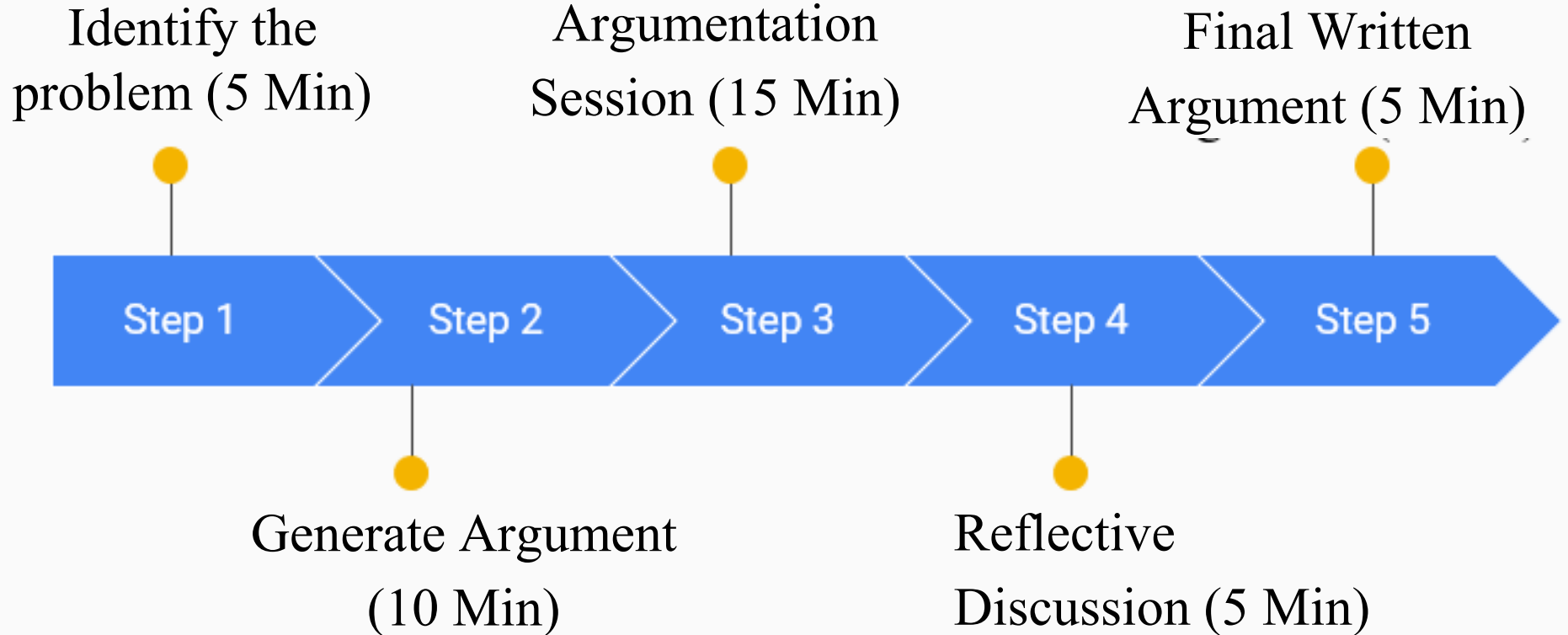
# Defining Argumentation

We define argumentation as the process of proposing, supporting, critiquing, and refining explanations

# Session Objectives

1. Introduce skills that will help teachers provide opportunities for success in science for all students
2. Introduce teachers to the argumentation strategy
3. Provide an understanding of argumentation as a social process

# Steps in the Argumentation Process



# How to Organize Your White Board

Question

Group Names

Your Claim

What is your explanation or answer to the question?

Your Evidence

What supports your claim?

Your Rationale

Why does it support your claim?

# The Phenomenon

Make sure you have the following

- Matches
- Tea bag
- Scissors
- Variety of markers
- Eraser
- Post its
- Watch glass
- White board

Alternative activity

- Transparent plastic cups
- Rubbing alcohol
- Ice



# Directions for the Activity

- Remove all content from tea bag and trash the tea leaves
- Convert tea bag into a cylinder and stand it on a watch glass
- Use matches to light the top of tea bag
  - Note-when working with students, this part should be a demonstration performed by the teacher
- What do you observe? What question comes to mind?

# Directions for Alternative Activity

Each group to pick up activity materials

To the rubbing alcohol in the cup, add a few ice cubes

Observe what happens within 5 minutes

What questions come to mind?

# How to Develop a Team Argument

Develop a question and write it on the board

Generate a claim- write your **claim** down on the board

Write down the **evidence** that supports your claim

Write down the scientific principles behind the evidence (**Reasoning**)

Every member of the team must contribute to Argument

# The Argumentation Session

The expert(s) remain behind

Groups rotate clockwise

The expert(s) explain their argument to the visitors

Visitors ask questions and critique the argument

Visitors leave critique on post-it notes on the board

# The Reflective Discussion

The original groups reconvene and discuss what they learned

Use newly gathered information and critique to modify your argument

Teacher then leads a whole-class discussion

Ensure class reaches a scientifically acceptable conclusion

Discuss issues that were a common challenge for the group

# The Detailed Steps To Successful Argumentation

# Step 1- Problem and Research Question

Find an activity that captures student interest

Could be a puzzling phenomenon, a demonstration, a quick video, a picture etc

Include information about the nature of artefact they will need to produce

# Step 2: Tentative Argument

The students create a tentative argument that consists of

**Claim-** answer to research question

**Evidence-** Data that has been analyzed and interpreted

**Reasoning-** A rationale why the evidence used is important and relevant

The CER should be written on a medium visible to all students



# Step 2: Tentative Argument

Students engage in productive talk and collaborate

Students evaluate competing ideas

This may be challenging to students

# The Teacher's Role

Circulate throughout the room from group to group

Keep students on track with questions

You may develop a set of questions that students can use as a guide

At the beginning, students may need scaffolding

# The Round Robin Argumentation Style

One or two members of the group (expert) stays

Experts share group's ideas

Other group members rotate to different groups

# Step 3: The Argumentation Session

Students share, evaluate and revise their arguments

Use the round robin format for step 3

Be visible- move around and ask questions such as

- How did you analyze the available data?
- Was there any data that did not fit with your claim?
- Why is the evidence important?

# The Teacher's Role

Ask students questions such as:

- Do you think their analysis is accurate?
- Do you think their reasoning is appropriate?
- Do you think their interpretation is correct?

Encourage students to think

It is not the time to let students know if they are correct or wrong

# Step 4: Reflective Discussion

The original groups reconvene and discuss what they learned

Students should then modify their tentative argument as needed

Teacher then leads a whole-class discussion

Ensure class reaches a scientifically acceptable conclusion

Discuss issues that were a common challenge for the group

# Step 5: The Production of a Final Written Argument

Each student produces a final argument in writing

CER outline and rubric provided

Consider distributing CER template Google Classroom

# Argumentation: A Central Component of 3D Learning

Review the Science and Engineering Practices

Circle performance expectations covered today

Share with class how Argumentation



# Prerequisites For Argumentation

Students need prior exposure to CER

Refresh students knowledge of CER if needed