Session S019: Thursday, November 9, 10:20 am – 11:10 am

MAKE THEM THINK!

ENGAGING STUDENTS IN PRODUCTIVE STRUGGLE

HEATHER HOWINGTON – UNIVERSITY OF NORTH GEORGIA
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Who Dunnit???

Someone’s been murdered and it’s your job to solve the crime.

**Basic Rules:**

- You can only read what is on your cards to the rest of the group. No showing your cards to other members of the group!
- You cannot write anything down! You are only allowed to communicate verbally.

In groups of 7 or 8, it is your goal to solve the mystery:

**Who died?**
**Where did they die?**
**How did they die?**
**What time did they die?**
**Who was the killer?**
**Why was the victim killed?**

This activity was adapted from: Dr. Catherine Roberts, Northern Arizona University, 1997
These clues were adapted from: Learning Discussion Skills Through Games, Gene and Barbara Dodds, Stanford, Citation Press/Scholastic Books 1969
Who Dunnit Murder Mystery Clues

1. Mr. Kelley had destroyed Mr. Jones business by stealing all of his customers
2. Mr. Jones told Mr. Kelley that he was going to kill him
3. The elevator operator saw Mr. Kelley’s wife go to Dr. Scott’s apartment at 11:30 pm
4. Ms. Smith saw Mr. Kelley go to Mr. Jones’ apartment building at 11:55 pm
5. Mr. Jones shot an intruder at his apartment building at midnight
6. Only one bullet had been fired from Mr. Jones’ gun
7. Mr. Kelley’s blood stains were found on the carpet in the hall outside of Mr. Jones’ apartment
8. The elevator operator reported to police that she saw Mr. Kelley at 12:15 am
9. When the elevator operator saw Mr. Kelley, Mr. Kelley was bleeding slightly, but did not seem too badly hurt
10. The elevator operator saw Mr. Kelley go to Dr. Scott’s room at 12:25 am
11. A knife with Mr. Kelley’s blood on it was found in Ms. Smith’s yard
12. The knife found in Ms. Smith’s yard had Dr. Scott’s fingerprints on it
13. Ms. Smith said that nobody left the apartment building between 12:25 am and 12:45 am
14. The elevator operator went off duty at 12:30 am
15. The elevator operator said that Ms. Smith was in the lobby of the apartment building when she went off duty
16. Mr. Kelley’s body was found at 1:30 am
17. Mr. Kelley’s body was found in the park
18. Mr. Kelley had been dead for one hour when his body was found, according to a medical expert working with the police
19. When he was discovered dead, Mr. Kelley had a bullet hole in his thigh and a knife wound in his back
20. It was obvious from the condition of Mr. Kelley’s body that it had been dragged a long distance
21. Mr. Kelley’s blood stains were found in Dr. Scott’s car
22. When police tried to locate Mr. Jones after the murder, they discovered that he had disappeared
23. The bullet taken from Mr. Kelley’s thigh matched the gun owned by Mr. Jones
24. Mr. Kelley’s wife disappeared after the murder
25. Police were unable to locate Dr. Scott after the murder
26. The elevator operator said that Mr. Kelley’s wife frequently left the building with Dr. Scott
27. Ms. Smith often followed Mr. Kelley

Who died? Mr. Kelley
Where did they die? Dr. Scott’s apartment
How did they die? Stab wound in the back, the gunshot wound was just superficial
What time did they die? 12:30 am
Who was the killer? Dr. Scott
Why was the victim killed? Mr. Jones accidentally shot Mr. Kelley in the leg, mistaking him for an intruder. Mr. Kelley, being injured, went to Dr. Scott’s apartment to get some medical care for his leg wound. Upon arriving at Dr. Scott’s apartment, Mr. Kelley found that his wife was already there. She was having an affair with Dr. Scott. Surprised by Mr. Kelley’s arrival at his apartment, Dr. Scott stabbed Mr. Kelley in the back as he entered the door. Dr. Scott and Mrs. Kelley disposed of the body in the park and disappeared together.
Mr. Kelley had destroyed Mr. Jones business by stealing all of his customers.

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The Green Glass Door

Only certain things can pass through the Green Glass door. Can you figure out what they all have in common?

Basic Rules:

- You can only ask the instructor questions about what can pass through the green glass door.

  For example, you can ask the question “Can a zebra pass through the green glass door?”

- Your instructor will answer with a simple yes or no.

- Students will alternate asking questions until all students have found the solution to the question of what can pass through the green glass door.

- Once you are confident that you have found the solution to what can pass through the green glass door, continue to ask questions to reinforce your belief and to help students reach the same conclusion.
The Green Glass Door Facilitation Prompts

1. Start the activity by telling the students one thing that can pass through the green glass door as well as one thing that cannot pass through the green glass door.

   For example:

   Coffee can pass through the green glass door, however, tea cannot.
   Giraffes can pass through the green glass door, however, elephants cannot

2. Try to make it fun for the students. Incorporate their names into the activity and try to think on the fly as students continue to ask their own questions.

3. If students are struggling while trying to reach the solution, offer up some hints:

   - Tell them it may help to write things down
   - Have them make a list of those things that can pass through the green glass door and those things that cannot pass through the green glass door
   - Ask them if they notice any patterns in these lists.

Solution to the problem:

Only those things that have double letters are allowed to pass through the green glass door.
MAKE THEM THINK!

ENGAGING STUDENTS IN PRODUCTIVE STRUGGLE

HEATHER HOWINGTON – UNIVERSITY OF NORTH GEORGIA
MIKE SIEVE – RIDGEWATER COLLEGE
WHAT IS PRODUCTIVE STRUGGLE?

THIS IS NOT PRODUCTIVE STRUGGLE

RATHER IT IS

UNPRODUCTIVE STRUGGLE!
WHAT IS PRODUCTIVE STRUGGLE?

THIS IS PRODUCTIVE STRUGGLE!
WHAT IS PRODUCTIVE STRUGGLE?

**Unproductive Struggle** is when “students repeatedly use strategies that have led to frustration and failure in past experiences, hoping that magically, this time things will be different and will lead to success” (Howington & Sieve, 2017)

**Productive Struggle** is when "students expend effort to make sense of mathematics, to figure something out that is not immediately apparent. We do not use struggle to mean needless frustration or extreme levels of challenge created by nonsensical or overly difficult problems.” (Hiebert & Grouws, 2007, p. 387)
INTRODUCING PRODUCTIVE STRUGGLE

• NON-MATHEMATICAL PROBLEM SITUATION
• NON-INTIMIDATING FASHION
• MAKE IT FUN FOR THE STUDENTS
WHO DUNNIT???

Someone’s been murdered and it’s your job to solve the crime!
WHO DUNNIT???

In groups of 8 or 9 students, it is your goal to answer the following questions:

Who died?
Where did they die?
How did they die?
What time did they die?
Who was the killer?
Why was the victim killed?
Basic Rules:

You can only read what is on your cards to the rest of the group.

No showing your cards to other members of the group!

You cannot write anything down!

You are only allowed to communicate verbally.
WHO DUNNIT???

What difficulties did you encounter in trying to complete this task?

What strategies did you employ in attempting to solve the problem?
Only certain things can pass through the green glass door.

Can you figure what they are?
HOW DOES ONE LEARN?

• How is a typical math class set up?
• How is mathematics taught?
• What do you do when you are in a math class?

VS.

• How is a typical English class set up?
• How does one learn to cook?
• How do you learn to play a musical instrument?
How does one learn?

We learn by doing... NOT by watching!

At times we may feel like we will never get it. The truth is, when we struggle, it’s not a sign that you can’t cut it. Usually it’s a sign that you’re learning!
In this class, we are going to do problems that are going to stretch you beyond what you know.

WE DO THIS ON PURPOSE, SO THAT YOU LEARN!

In the past, when some people got a problem wrong, they may have thought that they are just not math people.

EVERYONE HAS THE ABILITY TO DO MATH...IT JUST TAKES TIME AND PRACTICE!

The problems we work on in this class take three things: effort, a good strategy, and help from others.

REMEMBER THESE THINGS AND YOU WILL SUCCEED!
PRODUCTIVE STRUGGLE IN THE CLASSROOM

PRODUCTIVE STRUGGLE

CONTEXT

EXPLORATION

ENVIRONMENT

ROLES
In patients with multiple risk factors for heart disease, Lipitor reduces risk of heart attack by 36%.*

*That means in a large clinical study, 3% of patients taking a sugar pill or placebo had a heart attack compared to 2% of patients taking Lipitor.
This class will be different in many ways from other math classes you may have been in. You are going to interact with each other quite a bit and talk to each other about mathematical reasoning. I will put you into groups, and I will expect that you will contribute to the discussion of the problems that your group is working on.

- Everyone gets a chance to talk
- Respond with respect
- Support each other in working together
BE A FACILITATOR

Video courtesy of Carnegie Math Pathways
EMBRACE FAILURE

F.A.I.L.
First Attempt In Learning

PRAISE THE PROCESS RATHER THAN THE SOLUTION
QUESTIONS???

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