

CRITICALLY INFORMED DIALOGIC ACTIVITY

Class: CVEN 3323: Hydraulic Engineering

Topic: Type I, II, and III Pipe Flow Problems

Lesson Focus and Goals:

- To understand how everyday water systems connect to technical pipe flow concepts, while developing engineering intuition through personal observations and collaborative knowledge construction.
- To recognize how the mathematics of pipe flow problems relates to real experiences with water and how different factors impact water behavior in various systems.

General Outline of Dialogue Activity/Sketch of Facilitation Plan:

The traditional engineering pedagogy often relies on formula memorization and abstract problem-solving without connecting concepts to students' lived experiences. This dialogic approach challenges this tradition by placing students' observations of water systems at the center of learning about pipe flow problems. Rather than beginning with equations and then moving to applications, we'll start with personal experiences and collaboratively build connections to the technical concepts. This approach acknowledges students as carriers of valuable experiential knowledge while democratizing the learning process through structured dialogue protocols.

Structure/ Activity:

On this day, we will begin with a "Chalk Talk" activity where photos of various water systems (home plumbing, campus fountains, city water infrastructure) are posted around the room. Students will silently circulate, writing observations about water flow behaviors they've noticed in similar systems and responding to peers' comments. This allows even technically hesitant students to contribute their experiential knowledge.

After the silent dialogue phase, I'll use "Asking for Themes" to help students collectively identify patterns in their observations, enhancing their ability to recognize hydraulic principles in everyday experiences. I'll then introduce the three types of pipe flow problems, connecting them to the observed water behaviors.

Next, we'll implement a "Jigsaw" approach where students form expert groups focused on one type of pipe flow problem (Type I, II, or III). Each group will analyze how their assigned problem type relates to specific water systems noted during the Chalk Talk. The groups will then reconfigure into teaching teams with representatives from each problem type to share their analysis.

We'll continue with a "World Café" format where students rotate between tables focused on different water systems, drawing and writing their understanding of how pipe flow equations explain the behavior they observe. Throughout this process, I'll use "Diagnostic Questions" to probe their thinking: "What led you to conclude that pipe roughness is the primary factor in this system?"

As a final reflection, each student will identify one water system they regularly encounter and explain which type of pipe flow problem would best help analyze it, sharing their insights through a "Focusing Four" protocol to consolidate our learning about how engineering principles manifest in everyday water experiences.

GENERAL OVERVIEW OF DIALOGIC PRACTICES

Protocol 1: Chalk Talk

Justification:

- To allow students to share their observations of water systems without verbal pressure, particularly valuable for engineering students who may have rich observations but be hesitant to speak in a large group.

Advantages:

- Provides alternative mode of participation for students uncomfortable with verbal sharing
- Creates visual documentation of collective knowledge about water systems
- Allows simultaneous participation from all students
- Permits students time to process technical observations before sharing

Pitfalls:

- Some students may contribute minimally or not at all
- Written observations may lack depth without verbal elaboration
- Technical misconceptions might go unchallenged in the silent phase

Protocol 2: Jigsaw

Justification:

- To develop deep expertise in one type of pipe flow problem while ensuring all students ultimately understand all three problem types through peer teaching.

Advantages:

- Creates collective responsibility for understanding complex technical material
- Develops teaching skills alongside technical knowledge
- Ensures each pipe flow problem type receives focused attention

Pitfalls:

- Quality of learning depends on the expertise developed in initial groups
- Some students may dominate the teaching process
- Engineering students sometimes resist peer teaching, preferring instructor explanation

Protocol 3: World Café

Justification:

- To encourage visual and spatial representation of pipe systems and fluid dynamics, allowing students to document their understanding in multiple modalities.

Advantages:

- Integrates drawing and writing to represent complex hydraulic systems
- Creates artifacts that document evolving understanding of pipe flow concepts
- Allows movement and interaction in what might otherwise be a static engineering classroom

Pitfalls:

- Focus may shift to artistic representation rather than technical accuracy
- Some students may be reluctant to draw technical concepts
- Table hosts need sufficient technical knowledge to guide discussions
- Time management can be challenging with multiple rotations

Protocol 4: Focusing Four

Justification:

- To help prioritize the most important concepts from many possible variables in pipe flow analysis, encouraging students to distinguish critical factors from secondary considerations.

Advantages:

- Helps distill complex hydraulic principles to core concepts
- Encourages advocacy for ideas based on technical merit
- Creates consensus around key pipe flow principles
- Provides structured way to conclude technical discussions

Pitfalls:

- May oversimplify complex hydraulic relationships
- Voting might prioritize intuitive concepts over technically accurate ones

Facilitator Move 1: Asking for Themes

Justification:

- To implement collective identification of patterns in water system observations rather than having the instructor dictate these connections.
- To create student ownership of the technical analysis process.

Implementation:

- After the Chalk Talk activity, I'll ask students to review all comments and identify recurring themes in water behavior observations
- I'll pose questions like "What patterns do you notice in how water behaves across these different systems?"
- We'll collectively list these themes on the board, creating a visual representation of our collective knowledge

Facilitator Move 2: Diagnostic Questions

Justification:

- To probe the reasoning and assumptions behind students' analyses of water systems.
- To develop deeper engineering thinking by focusing on causes rather than just effects.

Implementation:

- When students make claims about water system behavior, I'll ask "What led you to that conclusion?"
- During the Jigsaw activity, I'll probe expert groups with "What evidence supports your understanding of friction factors in this system?"
- These questions help students articulate their reasoning process and identify gaps in their technical analysis