Implementation Plan and Teaching Notes for

Why does Blood Flow Change? Investigating the Math of Blood Flow Dynamics – Modeling Variation Activity

Course and Format:

This activity was designed for a face-to-face College Algebra class.  This activity includes a pre-class assignment that introduces the concept of variation, an in-class activity that explores the relationship between blood flow, pressure and the factors of resistance and a follow up assessment.

Purpose:

The purpose of the **pre-class activity** is to introduce the concept, the equations and graphs that are associated with quantities that vary directly or inversely with each other.

The purpose of the **in-class activity** is for students to observe the changes in blood flow that are caused by changes in pressure, radius, length, or viscosity.  Students will connect what they observe to the concept, the equations, and graphs that are associated with quantities that vary directly or inversely with each other.

The purpose of the **assessment** is for students to create a mathematical model of the changes in blood flow that are caused by changes in pressure, radius, length or viscosity.

Learning Objectives:(for the entire collection of activities)

Biology:

1) Interpret the equation that relates blood flow to pressure and resistance

2)  Explain the impact of changes in resistance (pressure, radius, length and viscosity) on blood flow

Mathematics:

1)  recognize direct and inverse variation relationships in data sets.

2)  model the variation relationship observed in data with an equation.

3)  Solve an equation to calculate the constant of variation for a data set

4) Use the equation to predict additional values

5) Create a graph of the data and the equation

6)  Predict additional values based on the type of variation

Data Literacy:

1. Estimate additional values based on the graph
2. Interpret graphs

Implementation and Andragogy:

Variation Ticket to Enter is **a pre-class assignment** where students are expected to complete a worksheet based on information they read and a video they watched.  The completed worksheet should be either submitted electronically before class or shown to the instructor as they enter the classroom.  The Variation Ticket to Enter does not need to be graded for correctness.  Answers should be reviewed during class time.  Answers could be projected, and time given for students to ask questions.  Class time allotted to this should be approximately 5 minutes.

 For the **in-class activity**, students should be placed into small groups of 2 - 4 people.  Groups should have access to a computer to access the simulation.  Each student should complete their own copy of the worksheet.  The instructor should move between the groups making certain that they are seeing the variation relationships and modeling them correctly.

Students should complete the **assessment** individually.  The assessment question could be used alone or placed on a quiz or exam.

Time to complete the task:

**Pre-class:**  Students outside of class should expect to spend about 10 - 15 minutes.  The instructor should spend approximately 5 minutes reviewing the answers and answering any questions in class.

**In-class:** The activity will take students about 30 minutes to complete.

This **assessment** question will take students about 10 minutes or less to complete.

Conclusion and Future Plans:

The Variation-Ticket-to-Enter leads into a math class where students explore the relationships between blood flow, pressure, and the factors of resistance.  The assessment is focused on students being able to recognize a direct or inverse variation relationship in data and to be able to create a mathematical model to capture the relationship. All the pieces of this activity are designed for a math classroom. They place more emphasis on the math objectives.  A biology classroom would place more emphasis on the biology objectives, with the math creating a foundation to understand the biology.  Ideally the students would complete the activity in both math and biology to increase their understanding.

In the math class, this activity could be paired with teaching about identifying and modeling variation relationships presented in words. Students should be given opportunity to work with homework questions that are presented with data and with words before being assessed on the topic of variation.