**Middle Level Mathematics Lesson Plan**

**Course/ Grade Level**: Middle Level Mathematics (Grades 6-8)

**Common Core State Standards addressed:**

* 6.RP.A.3 - Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
* 6. SP.A.2 – Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
* 6. SP.B.5 – Summarize numerical data sets in relation to their context.
* 7. RP.A.2 – Recognize and represent proportional relationships between quantities.
* 7. SP.A.1 – Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
* 7. SP.A.2 – Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
* 7. SP.B.4 – Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
* 7. SP.C.5 – Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
* 7. SP.C.6 – Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
* 8. F.A.1 – Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
* 8. F.B.5 – Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
* 8. SP.A.1 - Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

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| **Goals:** Students will be able to use technology to collect data, generate different scenarios using a model, and interpret the data from different scenarios. |
| **Objectives:**  Students will use a computer simulation of colon cancer to model cancer growth and collect data. This data will then be used to complete a worksheet that will ask questions about range, measures of central tendency, ratios, rates, and proportions. This activity will connect real world problems to mathematics. Students will be able to properly calculate measures of central tendencies and apply ratios, rates, and proportions. |
| **Materials Needed:** Pencil, worksheet (provided by teacher), computer lab or smart board or projector, access to internet, basic calculator. |
| **Opening:** Introduce colon cancer background to students (reference paper), explain and demonstrate the cancer model. Explain the activity and how it will be used to practice the recent mathematics lessons of rates, ratios, proportions, and measures of central tendency. |
| **Meaningful Activities:** The students will be following directions on the pre-made worksheet, running different simulations on the model, collecting data, and answering mathematics based questions about the data. |
| **Closure:** Ask students if they found anything interesting about the model and if it was helpful to understand the topics. Summarize the lesson and begin a transition into the next lesson. Make sure the students do not have any questions about the standards addressed in this lesson. |
| **Homework Assigned:** Finish worksheet if unable to complete during class time. Make sure all the simulations are completed before class is over so students have the necessary information to finish the worksheet. |
| **Differentiation:** If some students are struggling with the concepts or the class is having a hard time working the model, students could work in small groups. Advanced computer science students could even begin to manipulate the code or find simulations on the *NetLogo* model library to manipulate. |
| **Assessment:** The worksheet can be graded as a classwork and/or a homework assignment. |

References:

National Governors Association Center for Best Practices, Council of Chief State School Officers, Common Core State Standards (Mathematics), *National Governors Association Center for Best Practices, Council of Chief State School Officers, Washington D.C.*, (2010).