Instructional Design

Probability

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EDTL 7100

Statement of Purpose

The eighth grade math curriculum is extremely important for student’s success in the future. Students will learn about number sense, operations, measurement, geometry, spatial sense, patterns, functions, algebra, data analysis, and probability. These areas of focus provide students with background knowledge for higher-level math classes, depending on their future career pursuits. It also provides students with skills that are critical for success in society. This unit focuses on three of the larger topics in the eighth grade content standards graphing lines, geometry and probability. Providing problems with real life applications allow students to develop problem-solving skills through realistic and real life experience. Dewey stated, “that education in order to accomplish its ends both for the individual learner and for society must be based upon experience (Cahn, 1997).”

This unit is to help provide a mathematical base for future math classes. This is the last course students are required to take before they begin to peruse their own routes and goals for future careers and success. Some students may complete math courses at much higher levels others may only advance to meet minimum requirements. All students need to experience success at this level in order to have the base needed for their future pursuits. With the great importance of mathematics in the future success of students it is important that the material is presented to students in a form that will allow them to be successful. For this reason material will be presented following a constructivist approach. “Learning is powerfully affected by prior experience, perceptions of relevance to self and society, and the context in which learning occurs (Chiarelott, 2006).” The constructivist approach better allows for the delivery of material that can fully meet the learners’ needs.

The real world applications for this topic are immense. Students need to have the ability to understand graphs and tables to make quality and educated decisions from voting to choosing benefit packages. They also need to understand the value of accurate sampling in order to ensure they are not being lead astray. Students geometry skills will come in handy all though life as it will help them to better understand the values of good and services. “To be a well-informed citizen and a participant in the knowledge economy, Americans must be mathematically literate. (US Department of Education)”

**Unit Intended Learning Outcomes**

**Subunit One: Graphing Lines**

* Students will compare the slope or rate of change in a linear situation. (Evaluation)
* Students will calculate x and y intercepts. (Application)
* Students will be able to formulate and manipulate equations in Point Slope Form as well as Slope Intercept Form. (Syntheses)
* Students will classify direct variation equations and problems. (Application)
* Students will compare linear inequalities to justify possible solutions. (Evaluation)
* Students will create lines of best fit if given a scatter plot. (Syntheses)

**Subunit Two: Geometry**

* Students will analyze the relationship between the area and perimeter of similar figures to understand the relationships that exist between dimensions. (Syntheses)
* Students will create diagrams and nets to help them formulate solutions to complex area and perimeter problems. (Syntheses)
* Students will calculate surface area and volume of 3D shapes using established formulas. (Applications)
* Students will create alternative 3D figures with equal volumes and surface areas. (Synthesis)
* Students will explain the strengths and weaknesses of various 3D figures for everyday applications. (Evaluations)

**Subunit Three: Probability**

* Students will assess surveys and samples to check for bias. (Evaluation)
* Students will compose simulations to examine possible outcomes. (Syntheses)
* Students will calculate and classify dependent and independent events. (Applications)
* Students will calculate and classify permutations and combinations. (Applications)
* Students will criticize decisions and predictions by analysis of probability. (Evaluations)

Pre-Assessment of Eighth Grade Math

(Graphing Lines, Geometry, Probability)

Circle the number that best resembles your knowledge of the following.

1 – never seen 2 – below average 3 – average 4 – above average 5 – expert

1. Percents 1 2 3 4 5

2. Ratios 1 2 3 4 5

3. Range 1 2 3 4 5

4. Fractions 1 2 3 4 5

5. Finding Perimeter 1 2 3 4 5

6. Finding Area 1 2 3 4 5

7. Finding Volume 1 2 3 4 5

8. Surface Area 1 2 3 4 5

9. Circumference 1 2 3 4 5

10. Numerator and Denominator 1 2 3 4 5

11. Making Tables with Integers 1 2 3 4 5

12. Coordinate Plane 1 2 3 4 5

13. Axes (X-Axis & Y-Axis) 1 2 3 4 5

14. Origin 1 2 3 4 5

15. Quadrants 1 2 3 4 5

16. Ordered Pairs 1 2 3 4 5

17. Coordinates 1 2 3 4 5

18. Graphing Points 1 2 3 4 5

19. Creating T-Tables 1 2 3 4 5

**Answer the following questions to the best of your ability. Show your work.**

1. Write each ratio in simplest form

5:50 95to19 20/100

2. Write each fraction as a decimal

52/100 3/5 2/9

3. Write each fraction as a percent

19/100 2/3 9/20

4. Add and Simplify

3/8+1/4+1/6 1/3+1/4+1/5

5. Multiply and Simplify

2/3x6/7 13/52x3/51 4/5x11/4

6. Evaluate

16^2 9^3 (1/2)^3

7. Multiply

(1/2)(6)(4^2) 2(3.14)(5^3) (2/7)(4^2x4)

8. Evaluate each expression for the given value

3X+2 for X=5

3(X+2) for X=-3

9. Solve for the variable

3X+1=7

5X+3=2X

10. Tell whether the ordered pair (2,-6) is a solution to the following equations.

-3X=Y -2y+4=X -4Y-4=10X

**Lesson Plan – Day One**

**Content to be Learned**

* Students will assess surveys and samples to check for bias. (Evaluation)
* Students will compose simulations to examine possible outcomes. (Syntheses)
* Students will calculate and classify dependent and independent events. (Applications)
* Students will calculate and classify permutations and combinations. (Applications)
* Students will criticize decisions and predictions by analysis of probability. (Evaluations)

**Time Period Objectives:**

* Students will be able to identify a permutation.
* Students will be able to calculate a permutation based on a problem situation.

**Materials Needed:**

* Student Notebooks
* Chalk Board
* Exit Pass

**Procedures:**

1. Introductory Activity: (10 minutes)
   * Provide the students with an example, for instance if we were given the three letters A,C and T the order of those three letters would effect the resulting word. Have students list all the possible results of ordering those three letters.
   * Ask students to think of a situation in which the order is extremely important. Have the students write their examples in their notebooks.
   * Have the students share several of the examples they have come up with. Record three of the shared examples on the chalkboard (choose three that have fewer possible results).

2. Developmental Activity: (20 minutes)

* With the students working in pairs have the students list all the possible outcomes of the first two shared examples that are written on the chalkboard. Then have the students’ write why the order of each of those results affected the final outcome.
* Ask for students to share their group’s results with the class. Have them record their results on the chalkboard. Ask the students to double check to ensure all the possible results were listed.
* With their partners ask the students to find all the possible outcomes of a marathon race in which 45 runners competed and only the top 10 runners where placed. Allow the students to work for a minute before stopping them. Ask what is so discouraging about this problem? (the total number of possibilities is high, if they leave out a possibility they can get the problem wrong, ect.)
* Explain to students how a factorial can be used to solve the A,C and T problem at the beginning of class. Number of choices for the first letter X the number of choices for the second X the number of choices for the third (3X2X1) this equals the total number of possibilities in this case 6. Show the students how to use their calculators to solve factorials. Ask students if using factorials can solve all permutation problems? Example would a factorial method work for the marathon problem?
* Show students how to solve permutation problems where the number of things does not equal the number of things taken (nPr). Using the marathon problem.

3. Concluding Activity: (5 minutes)

* Have students solve the remaining problem that was brainstormed on the board by both listing out all the possible outcomes as well as the nPr method. Review the results.

4. Key Questions:

* What is a permutation?
* What are three ways to calculate a permutation?

**Summary/Closure/Evaluation:**

1. Closure/Evaluation (10 minutes)

* Have students create an exit pass. Defining a permutation, sharing an example and explaining three ways to solve (list, factorial, nPr).

**Lesson Plan – Day Two**

**Content to be Learned**

* Students will assess surveys and samples to check for bias. (Evaluation)
* Students will compose simulations to examine possible outcomes. (Syntheses)
* Students will calculate and classify dependent and independent events. (Applications)
* Students will calculate and classify permutations and combinations. (Applications)
* Students will criticize decisions and predictions by analysis of probability. (Evaluations)

**Time Period Objectives:**

* Students will be able to identify a combination.
* Students will be able to calculate a combination based on a problem situation.

**Materials Needed:**

* Student Notebooks
* Chalk Board

**Procedures:**

1. Introductory Activity: (10 minutes)

* Ask students to recap the information they learned yesterday about permutations (definition, three ways to solve, ect.)
* Explain to students that today we will be talking about combinations.
* Ask students to share some common pizza toppings. List them on the calk board. Explain to students that they are allowed to create a three topping pizza. How many possible pizza’s could be made using the toppings listed? How is this different from what we discussed yesterday?

1. Developmental Activity: (20 minutes)

* In pairs have students create a mock menu for an ice cream sunday shop. The menu needs to include a list of toppings as well as ice cream choices. The shop is having a sunday sale in which customers choose 5 toppings and one type of ice cream for $3.75.
* When students have completed their menu design have the students trade menu’s with a neighboring group (Secrete Shoppers evaluating the shop). Explain that it is the Secrete Shoppers job to determine how many sunday options are available to them.
* Provide students with the nCr method of finding the total number of combinations.
* Have the Secrete Shoppers evaluate three other nearby shops menus.
* Ask the students which shops had the most/least combinations?

3. Concluding Activity: (5 minutes)

* Ask the students to explain what a combination is.
* Ask the students to explain how that is different from a combination.

4. Key Questions:

* What is a combination?
* How can you calculate the number of possible combinations?
* Explain the difference between a permutation and a combination?

**Summary/Closure/Evaluation:**

1. Closure/Evaluation: (10 minutes)

* Have students examine the menu they have created. For homework have the students explain how the number of ice cream flavors could affect the number of possible sunday combinations for their shop. Use math to support your reasoning.

**Lesson Plan – Day Three**

**Content to be Learned**

* Students will assess surveys and samples to check for bias. (Evaluation)
* Students will compose simulations to examine possible outcomes. (Syntheses)
* Students will calculate and classify dependent and independent events. (Applications)
* Students will calculate and classify permutations and combinations. (Applications)
* Students will criticize decisions and predictions by analysis of probability. (Evaluations)

**Time Period Objectives:**

* Students will be able to identify an independent event.
* Students will be able to calculate an independent event.

**Materials Needed:**

* Student Notebooks
* Chalk Board
* Trouble Game
* Elmo document camera
* Independent Events Worksheet

**Procedures:**

1. Introductory Activity: (5 minutes)

* Ask the students how many of them have ever played the board game Trouble. Show students the game under the Elmo giving a quick demonstrations of how it is played. Explain to students today we will be learning about the probability of independent events and how the game Trouble is a game of probability.
* Provide the students with examples using a pair of dice. What is the probability that I roll a P(even followed by a two)=3/6X1/6, ect.
* Have students define an independent event as well as how the probability can be found. P(A and B)=P(A)XP(B). In their math notebooks.

2. Developmental Activity: (25 minutes)

* Have students play a modified Trouble game in groups of 4. (Two dice and two game pieces only) During the game students need to record the probability of their piece getting bumped. Provide the students with a demo game under the Elmo. (Students can use page 541 for help on dice combinations)
* After the students have completed one practice game in their groups have students play again. This time if a student is caught recording the wrong probability by their peers they are out. The winners receive bonus points.

3. Concluding Activity: (5 minutes)

* Have the students create a problem in which the probability of an independent event is used. Then have them show the probability of that event and explain how to find the probability.

4. Key Questions:

* What is an independent event?
* How do you find the probability of an independent event?

**Summary/Closure/Evaluation:**

1. Closure/Evaluation: (10 minutes)

* Complete an Independent events worksheet for homework.

Probability of Independent Events/Review

Name:

Mike has a spinner with the numbers 1-8 listed. All the pieces are the same size. Find the probability of each event. Show your work.

1. P(even then even)
2. P(one then an even)
3. P(two then a five)
4. P(of a number less than five then a seven)
5. P(of two eights in a row)

Review

Seven runners compete in a race. Only the top 4 earn points for their teams. Find the total number of permutations.

The Burger Place offers 12 different toppings for a burger. Find the number of possible three topping burgers.

**Lesson Plan – Day Four**

**Content to be learned**

* Students will assess surveys and samples to check for bias. (Evaluation)
* Students will compose simulations to examine possible outcomes. (Syntheses)
* Students will calculate and classify dependent and independent events. (Applications)
* Students will calculate and classify permutations and combinations. (Applications)
* Students will criticize decisions and predictions by analysis of probability. (Evaluations)

**Time Period Objectives:**

* Students will be able to identify and define dependent events.
* Students will be able to calculate dependent events.
* Students will be able to differentiate between independent events and dependent events.

**Materials Needed:**

* Student Notebooks
* Student name sticks
* Candy
* Elmo document camera

**Procedures:**

1. Introductory Activity: (5 minutes)

* Pick five students nametags and place them on the Elmo. Ask students if they have ever heard of a reverse raffle. Explain what it is.
* Today we are going to conduct a mini reverse raffle. Using the five name sticks shown. Today we will be pretending we are all Mike.
* What is the probability that Mike is drawn first?
* Remove a name stick. What is the probability Mike is drawn now?
* Remove another stick. What is the probability now?
* Remove another stick. What is the probability now?
* Remove another stick. What is the probability now?
* Today we will learn how to find the probabilities in situations like this. This is called a dependent event. Explain why and give the students a definition for their notebooks.

2. Developmental Activity: (25 minutes)

* Show students a pile of candy on the Elmo (7 different pieces). Ask students to record their favorite piece in their notebook. Pick a piece of candy out one at a time until none remain. Have the students record the probability of their favorite candy being drawn each time.
* Show the students a pile of candy on the Elmo (12 pieces 4 each of three types). Have the students write down their favorite type of candy. Draw a piece one at a time until none remain. Have the students record the probability of their favorite brand being chosen until none remain.
* Have students find a partner that choose the same piece for the first trial and have the students find the probability for that dependent event. Repeat the process for the second trial.

1. Concluding Activity: (5 minutes)

* Have the students trade results of the probability trials with a neighbor. Have them check each other’s work to ensure they found the correct probability for each trial.

1. Key Questions:

* What are dependent events?
* How do you find the probability of dependent events?
* What is the difference between independent and dependent events?

**Summary/Closure/Evaluation:**

1. Closure/Evaluation: (10 minutes)

* The past two days students have worked with independent and dependent events. We have done examples of each in class. Take an independent example and explain how you could modify the trial to make it a dependent event. Take a dependent example and explain how it could be modified into an independent trial.

Game Board Project

For this project students will create a board game. The game can be based off an existing game or can be an original creation. The game must be multi-player and include several key components.

**Key Game Components:**

Probability creator (ex. dice, cards, spinner, ect.)

Multi-player

Rules

Multiple routes, locations, landing places

**Answer the following questions about the game you have created:**

What type(s) of probability is incorporated into your game. Use examples to support your statement.

If your game is similar to a game already created explain why your game would be better. If it is original explain why it should be marketed.

What are some potential flaws of your game design? How would you change that in future versions?

If you were playing your game explain a situation where you would have a high probability of success. Use actual real game probabilities to support your claim.

If you were playing your game explain a situation where you would have a low probability for success. Use actual real game probabilities to support your claim.

**Post-Assessment**

NAME:

**Steve has started a business selling lemonade. It cost him $.75 to produce a cup of lemonade for sale. He charges $1.19 per cup.**

* Write an equation for the cost per cup in both point slope and slope intercept forms.
* Graph the equation for the cost per cup and find the x and y intercepts.
* Does the equation for the cost per cup model direct variation? Explain.

**Find the volume and surface area of a rectangular prism with dimensions of 3ft. by 4ft. by 8ft.**

**Draw the net of the rectangular prism**

**How would the volume and surface area change if each side were multiplied by a scale factor of 3.**

**Find one other rectangular prism that would have the same volume of a 3x4x8.**

**A survey is sent by email to citizens of Oak Harbor about their Internet usage. Explain how this survey is flawed and how it could be modified.**

**Seven of fifteen students are chosen to go on a field trip. How many different student combinations can be created?**

**Eight Students Run a race only three are placed. How many different permutations are possible?**

**There are five red, two green and six blue candies in a jar. Find the following:**

P(red then a red with replacement) P(red then a red without replacement)

P(green then a blue with replacement) P(red then a blue without replacement)

References

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