

Curriculum Design for Mathematic Lesson – Probability

This curriculum design is for the 8th grade students who are going to learn “Probability” and trying to show the easiest way for them to go into this class.

The unit is to incorporate essential questions, unit questions, and standards and involve writing a storyline and concept map of the class (the activities, assessments, etc.)

By Christina Cheng

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Subject: Mathematics – Probability

Grade: 8

Students: 20

Instructor: Christina Cheng

Instruction hours: 14 hours (7 weeks)

Goals:

- * Students can recognize the relationship between Math (probability) and life.
- * Students can use the skills that they learn in the class to solve the problems of life.

Objectives:

- * Students will research base on current learning theories and work in groups. (They can learn communicating and cooperating in the teamwork.)
- * Students will show the result of their research (they can show the ability of problem solving and the technology of demonstrating and integration.)

Standard: (link to the flowing)

NSES

http://www.enc.org/reform/journals/ENC2280/nf_280dtoc1.htm

<http://www.nap.edu/readingroom/books/nses/html/>

P.A.S.S.

<http://www.sde.state.ok.us>

Schedule:

This schedule is designed from week-1 to week-7, 2 hours a week.

| Time | Hours | Key idea | Assessment |
|-----------------|----------------|---------------------------------|-----------------|
| 1 st | 1st-2nd hour | Outcome, event and sample space | Homework 1 |
| 2 nd | 3rd-4th hour | Mutually Exclusive Events | Homework 2 |
| 3 rd | 5th-6th hour | Rules for Probability | Homework 3 |
| 4 th | 7th-8th hour | Dependent Events | Research |
| 5 th | 9th-10th hour | Conditional Probability | Research |
| 6 th | 11st-12nd hour | Practice exercises | Self-evaluation |
| 7 th | 13th-14th hour | | Presentation |

Enduring Knowledge:

Student will able to...

Communicate what is probability.

Perform how to use probability.

Describe what they can get from probability.

Story Line

How to built students' understanding? (See figure1- story line)

The acronym WHERE stands for **where** are we headed, **hook** the students, **explore** the subject and **equip** the student, **rethink** our work and ideas, and **evaluate** results. [1]

Plan Learning Experiences and Instruction

1. **W** Orientation for the students in the 1st week. They will be given the schedule of this class. So, students will know what they will know and need to do in this class. In this unit, students know the most important thing – what is probability.
2. **H** In this unit, I try to have a hook stimulated by playing poker and other games; and then, invite students to pay more attention to join this class. (The unit unfolding maintains interest.)
3. **E** Lessons and activities equip students to effectively to prepare for their final performance task. Further more, students try to think about the deep meaning of the games we played last time.

4. **R** By practicing exercises (in the 6th week), they rethink the key ideas of the classes they took before. The unit will help them to revise their works and correct misunderstandings.

5. **E** I will give students the criteria and tell them what they require to do for their assessments. The unit providing students opportunities to consider the quality of their work, the value and the meaning of the task they do and how to exhibit their presentation.

6. After students' presentations (in the 7th week), they see the lessons and activities are connected and flow together. They know the big idea, overarching questions. Most students know clearly what is the most important and could connected all the lessons and activities.

Concept map: (See figure2)

This part includes Essential Questions (EQ) and Unit Questions (UQ) and will show how to perform this class. An Essential Question is the heart of the curriculum. An essential question is a question for students to think about before they going to the after curriculum – it helps students to objective. The essential question also is an organizer to structure and array of activities – it helps instructors to avoid the common “ potpourri” problem, which is the random assortment of well-intended activities with no structure. [2]

Those questions will be show in the first five classes. An essential question is a key idea of each unit.

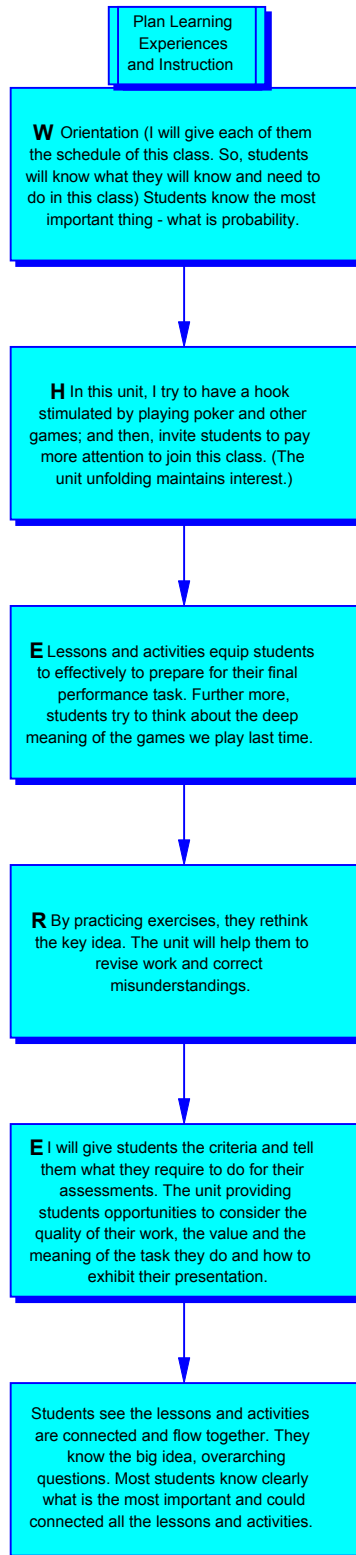


Figure 1: Story Line shows how to built students' understanding with WHERE theory.

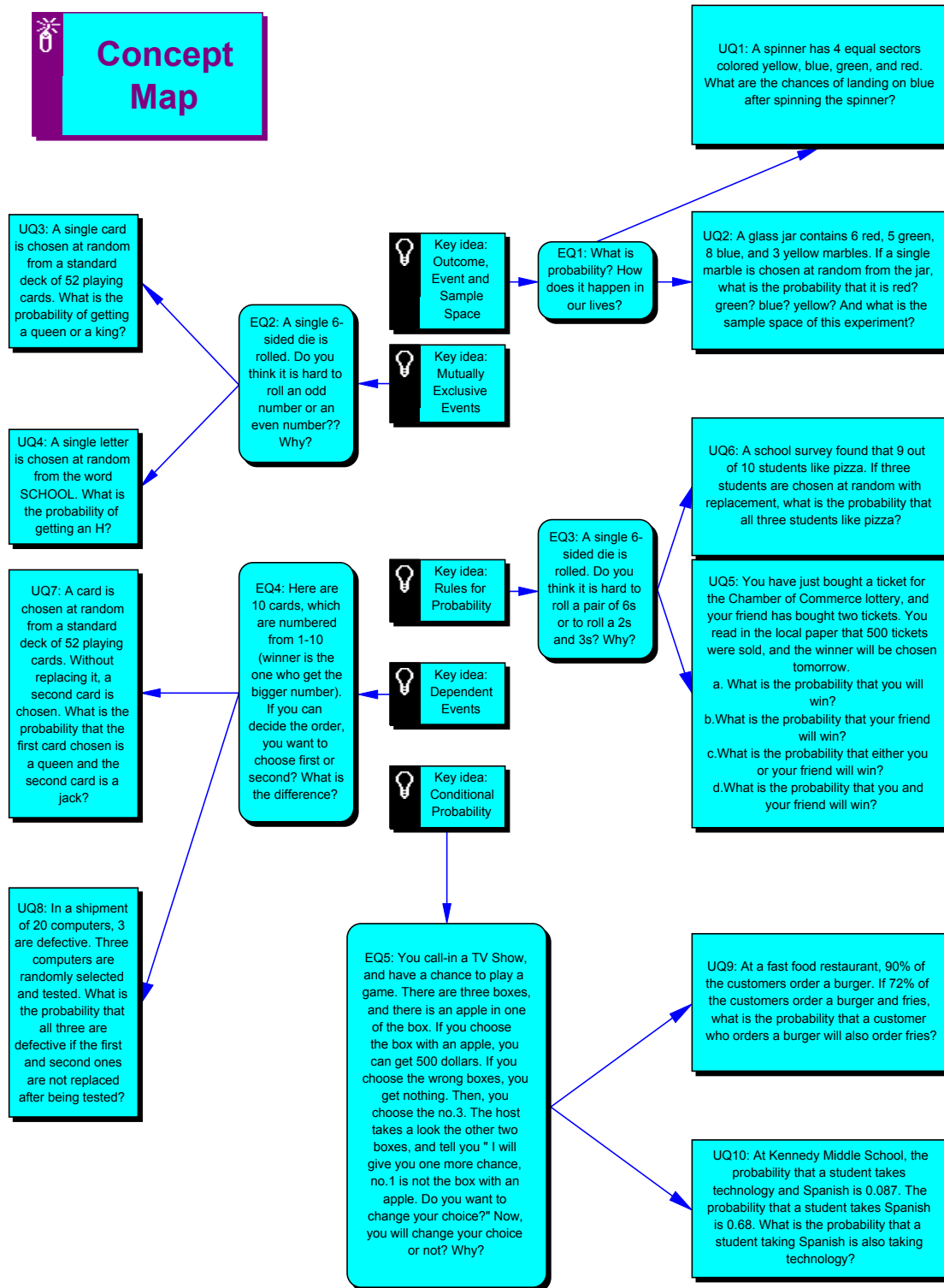


Figure 2: Concept Map shows how essential questions and unit questions incorporate and perform in this class.

Unit 1

Key idea: Outcome, Event and Sample Space

EQ1: What is probability? How does it happen in our lives?

Learning Activity

By playing games, we will discuss the probability of a spinner with 4 colors and a candy jar with 4 different colors marbles in it.

UQ1: A spinner has 4 equal sectors colored yellow, blue, green, and red. What are the chances of landing on blue after spinning the spinner?

UQ2: A glass jar contains 6 red, 5 green, 8 blue, and 3 yellow marbles. If a single marble is chosen at random from the jar, what is the probability that it is red? green? blue? yellow? And what is the sample space of this experiment? [3]

Introduction of probability:

| Definition | Example |
|--|--|
| An experiment is a situation involving chance or probability that leads to results called outcomes. | The experiment is spinning the spinner. |
| An outcome is the result of a single trial of an experiment. | The possible outcomes are landing on yellow, blue, green, or red. |
| An event is one or more outcomes of an experiment. | The event being measured is landing on blue. |
| Probability is the measure of how likely an event is. | The probability of landing on blue is one fourth. |

Homework 1

(See sheet 1 – homework sheet)

(Homework will be discussed in the next class.)

Key word: Certain and impossible events

1. A single card is chosen from a standard deck of 52 playing cards randomly. What is the probability that the card chosen is a joker card?
2. A glass jar contains 15 red marbles. If a marble is chosen at random from the jar, what is the probability that it is red?

Unit 2

Key idea: Mutually Exclusive Events

EQ2: A single 6-sided die is rolled. Do you think it is hard to roll an odd number or an even number?? Why?

Learning Activity

By playing cards, we will discuss the probability of a card in 52 cards.

UQ3: A single card is chosen at random from a standard deck of 52 playing cards. What is the probability of getting a queen or a king?

UQ4: A single letter is chosen at random from the word SCHOOL. What is the probability of getting an H?

*These events are not mutually exclusive since they can occur at the same time.

Homework 2

(Homework will be discussed in the next class.)

Just like homework 1, we will have some questions for students to think about.

Unit 3

Key idea: Rules for Probability

EQ3: A single 6-sided die is rolled. Do you think it is hard to roll a pair of 6s or to roll a 2s and 3s? Why?

Learning Activity

By discussing the probability of lottery, students will learn the rules of probability.

UQ5: You have just bought a ticket for the Chamber of Commerce lottery, and your friend has bought two tickets. You read in the local paper that 500 tickets were sold, and the winner will be chosen tomorrow.[4]

- a. What is the probability that you will win?

- b. What is the probability that your friend will win?
- c. What is the probability that either you or your friend will win?
- d. What is the probability that you and your friend will win?

*Addition Rule 1: When two events, A and B, are mutually exclusive, the probability that A or B will occur is the sum of the probability of each event.

$$p(A \text{ or } B) = p(A) + p(B)$$

*Addition Rule 2: When two events, A and B, are non-mutually exclusive, the probability that A or B will occur is:

$$p(A \text{ or } B) = p(A) + p(B) - p(A \text{ and } B)$$

UQ6: A school survey found that 9 out of 10 students like pizza. If three students are chosen at random with replacement, what is the probability that all three students like pizza? [5]

Multiplication Rule 1: When two events, A and B, are independent, the probability of both occurring is:

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

Homework 3

(Homework will be discussed in the next class.)

Just like homework 1, we will have some questions for students to think about.

Unit 4

Key idea: Dependent Events

EQ4: Here are 10 cards, which are numbered from 1-10 (winner is the one who get the bigger number). If you can decide the order, you want to choose first or second? What is the difference?

Learning Activity

By playing cards, we will discuss the probability of a card in 52 cards in a dependent event.

UQ7: A card is chosen at random from a standard deck of 52 playing

cards. Without replacing it, a second card is chosen. What is the probability that the first card chosen is a queen and the second card is a jack?

Definition: Two events are dependent if the outcome or occurrence of the first affects the outcome or occurrence of the second so that the probability is changed.

UQ8: In a shipment of 20 computers, 3 are defective. Three computers are randomly selected and tested. What is the probability that all three are defective if the first and second ones are not replaced after being tested?

[6]

Definition: The conditional probability of an event B in relationship to an event A is the probability that event B occurs given that event A has already occurred. The notation for conditional probability is $P(B|A)$.

Multiplication Rule 2: When two events, A and B, are dependent, the probability of both occurring is:

$$P(A \text{ and } B) = P(A) \cdot P(B|A)$$

Homework 4

Research beginning

Students will use the skills they learn now to do the research – In a game, what is the probability you will win?

(Detail → go to the **Assessment** part)

Unit 5

Key idea: Conditional Probability

EQ5: You call-in a TV Show, and have a chance to play a game. There are three boxes, and there is an apple in one of the box. If you choose the box with an apple, you can get 500 dollars. If you choose the wrong boxes, you get nothing. Then, you choose the no.3. The host takes a look the other two boxes, and tell you “ I will give you one more chance, no.1 is not the box with an apple. Do you want to change your choice?” Now, you will change your choice or not? Why?

Learning Activity

By objecting the examples of life, we will discuss what is “conditional probability”.

UQ9: At a fast food restaurant, 90% of the customers order a burger. If 72% of the customers order a burger and fries, what is the probability that a customer who orders a burger will also order fries?

UQ10: At Kennedy Middle School, the probability that a student takes technology and Spanish is 0.087. The probability that a student takes Spanish is 0.68. What is the probability that a student taking Spanish is also taking technology? [7]

Homework 5

Research

(Still keep going.)

Unit 6

Learning Activity

Practice Exercise

* There will be some questions for students to practice. Help them to find out some unclear concepts.

* Show them how to use power point to perform their presentations.

*** Self-evaluation**

(This is an evaluation for students to evaluate themselves. See sheet 2 – self-evaluation sheet.)

Students will get this sheet before they start practicing exercise. There are two columns for them to fill their scores; one is for the score you expect you can get before starting exercises, and another one is for the score you really get after exercises. Then, students can find clearly where they really are, and which parts they still have to keep working hard for themselves.

Homework 6

Prepare presentation (Detail → go to the **Assessment** part.)

Unit 7

Presentation

Every group will have 20-25 minutes to show their task. (Detail → go to the **Assessment** part.)

Assessment:

There will be two parts: Research and Presentation.

Research: When playing card, what is the probability that you will win? (Research will begin in the 4th week).

- **Experiment:**

When playing card, there could be several kinds special suits: One pair, Two pair, Three of a kind, Straight, Flush, Full House, Four of a kind, Straight Flush, Royal Flush.

Can you calculate the probability of every kinds special suit?

- **For example:**

(This is an example I will do for students.)

The probability of one pair →

(♦ Diamonds, ♥ Hearts, ♠ Spades, and ♣ Clubs)

Step 1: List all probable combinations.

(e.g., Diamond Ace & Heart Ace, Diamond Ace & Spade Ace, Diamond Ace & Club Ace...etc.)

Step 2: Calculate the probability of every kind probable suit.

(e.g., The probability for Diamond Ace & Heart Ace is $1/52 * 1/52$)

Step 3: Sum all the probability.

(e.g., First, sum the probability of all suits of Ace. It will be $6/2704$. Second, sum all the probability of all combinations of pair.

Then, you get the result of the research!!!)

| | ♦♥ | ♦♠ | ♦♣ | ♥♠ | ♥♣ | ♠♣ | Total |
|-------|---------------|---------------|---------------|---------------|---------------|---------------|--------|
| Ace | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | 6/2704 |
| 2 | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | 6/2704 |
| 3 | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | 6/2704 |
| | | | | | | | |
| K | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | $1/52 * 1/52$ | 6/2704 |
| Total | | | | | | | ? / ? |

- **Way:** Teamwork → students will be four groups (5 students in a group. The following table is the work assignment for each group. One team will do two different suits.)

| Team | Different suits | |
|------|-----------------|--|
| 1 | One pair | Two pair |
| 2 | Three of a kind | Four of a kind |
| 3 | Flush | Straight |
| 4 | Full House | Straight Flush (including Royal Flush) |

- **Requirement:**

- * Use the theories you learn in this class and support them. (e.g., Identify and extend patterns and use experiences and observations to make suppositions.)
- * Everyone in the group has to participate this experiment.
- * Apply a variety of strategies (e.g., restate the problem, look for a pattern, diagrams, solve a simpler problem...etc.) to solve problems. (Suggestion, not requirement.)
- * Describe the process that how you solve the problems (step by step).
- * Use a variety of representations to organize and record data (e.g., use concrete, pictorial, and symbolic representations).
- * Evaluate results to determine their reasonableness.

Presentation:

This is a part for students to show the research result.

- **Way:**

- * The students of 4 groups will show their research result with power point.

- * Every group has 15-20 minutes to perform.

- **Requirement:**

- * Use the theories you learn in this class.

- * Everyone in the group has to participate this experiment. (Group participating will be considered in the evaluation.)

- * Use technology to show your research result (power point).

- * Develop a variety of mathematical representations that can be used flexibly and appropriately (e.g., appropriate graphs to represent data)

- * Use a variety of representations to model and solve problems (e.g., geometric objects, pictures, charts, tables, graphs).

- **Note:** Those requirements are according to *The National Council of Teachers of Mathematics (NCTM)*, which has identified five process standards: Problem Solving, Reasoning and Proof, Communication, Connections, and Representation.

Evaluation criteria:

(See sheet 3 – evaluation criteria sheet)

The score will be given from 1-5

Research (Concept): (50%)

1. Organization and recordation of data.

2. Process (step by step).

3. Result of the experiment (reasonable or not?)

4. Concept of the probability.

5. Identify and support the theory you learn in the class.

Presentation (Display): (30%)

1. Organization

2. Use technology to present (power point)

3. Use appropriate and varied ways to present. (e.g., appropriate graphs to represent data) (e.g., geometric objects, pictures, charts, tables, graphs).

Participate: (20%)

(See sheet 4 – peer review sheet)

The score will be given from Na – 5

1. Showed up for group meetings.
2. Contributed ideas to the overall group presentation.
3. Met deadlines set forth by the group.
4. Interacted cooperatively with all members of the group.

<Sheet 1 – homework sheet>

<Sheet 2 – self-evaluation sheet>

Evaluation By Yourself!!!

Subject: Probability

Name: _____

Date : _____

This sheet will help you to evaluate how well you learn in this class.

How much do you learn in these lessons?

Are there any things you lose? If you do, give yourself a note.

Give yourself a score (from 1-10). Give a score before you start practicing exercises and give another score after you finish the exercises.

Compare them; then, you will know where you really are!

| Time | Key idea | Before | After |
|-----------------|--|--------|-------|
| 1 st | Outcome, event and sample space | | |
| | Note: | | |
| | | | |
| | | | |
| 2 nd | Mutually Exclusive Events | | |
| | Note: | | |
| | | | |
| | | | |
| 3 rd | Rules for Probability | | |
| | Note: | | |
| | | | |
| | | | |
| 4 th | Dependent Events | | |
| | Note: | | |
| | | | |
| | | | |
| 5 th | Conditional Probability | | |
| | Note: | | |
| | | | |

| | |
|--|--|
| | |
| | |

<Sheet 3 – evaluation criteria sheet >

Team no.: _____ Date: _____ Score:

Name: _____

A. Content

1. Organization and recordation of data

Disorganized 1 2 3 4 5 Well
organized

2.Process (step by step)

Vague 1 2 3 4 5 Concise
and clear

3.Result of the experiment

Unreasonable 1 2 3 4 5
Reasonable

4.Concept of the probability.

Disorganized 1 2 3 4 5
Correct and
or incorrect
significant

5. Identify and support the theories you learn in the class.

Minimal supporting 1 2 3 4 5 Well

B. Display

6. Organization

Hard to follow 1 2 3 4 5 Easy to follow

7. Use technology to present (power point)

Minimal display 1 2 3 4 5 Well

8. Use appropriate and varied ways to present (geometric objects, pictures, charts, tables, graphs...)

Minimal display 1 2 3 4 5 Well

Other comments

<Sheet 4 – peer review sheet >

Peer Review

5 4 3 2 1
NA
Excellent Good Average Fair Poor Not
Applicable

Names of Group Member

One _____

Two

Three _____

Four

| Activity/assignment | One | Two | Three | Four |
|--|-----|-----|-------|------|
| Showed up for group meetings. | | | | |
| Contributed ideas to the overall group presentation. | | | | |
| Met deadlines set forth by the group. | | | | |
| Interacted cooperatively with all member of the group. | | | | |

Other Note:

Reference:

- [1] Grant Wiggins and Jay McTighe “Understanding by Design”
8:115-133
- [2] Heidi Hayes Jacobs “Mapping the Big Picture: Integrating Curriculum
and Assessment” 4: 25-33
- [3] http://www.mathgoodies.com/lessons/vol6/intro_probability.html
- [4] B. Michael Thorne & J. Martin Giesen “ Statistics For The Behavioral
Sciences” 7:121-138
- [5] http://www.mathgoodies.com/lessons/vol6/independent_events.html
- [6] http://www.mathgoodies.com/lessons/vol6/dependent_events.html
- [7] <http://www.mathgoodies.com/lessons/vol6/conditional.html>