Probability with the Fundamental Counting Principle, Permutations and Combinations

Teacher: Taner Karakas
Grade Level: 12
Subject Area: Topics in Math
Content Focus: Counting methods and probability theory

(A) Relevant State and National Content Standards
1. 1.1.a. Describe relationships and make generalizations about patterns and functions.
2. 4.2.a. Analyze real-world problems using statistical techniques.
3. 4.3.a. Understand and apply the principles of probability in a variety of situations.

NCTM Curriculum Standard
Promote a "coherent" curriculum, in which an orderly and logical progression increases students' understanding of mathematics.

(B) Learners’ Background
Students in this course gain exposure to topics in college math courses at a pace that is appropriate for them. The course is designed to give students success at math and a positive math experience. Every area will focus on improving skills, problem solving and modeling accessible and relevant applications. The question: “When am I ever going to use this?” will be answered.

The students have learned about the fundamentals of probability and they have practiced problems relating to this topic. This particular lesson deals with applying their prior knowledge of all three counting methods to solve probabilities. There is no new vocabulary that the students will need to learn. This section focuses on bringing together everything that was already learned. This particular course does not require the students to take work home with them; therefore, all learning takes place within the classroom. Assessments are taken in the classroom and the students are allowed to use their notes and class work as resources.

One student who will require modifications will be referred to as Student A. Student A is diagnosed with ADD and her 504 plan outlines what she needs for accommodations. Student A receives extra time for tests, quizzes, and long written assignments, the use of note cards as memory devices for assessments, and additional scaffolding that will be designed by the teacher as the teacher sees appropriate. Student B is a low-level learner who is in the general education setting and he will require guided practice and positive reinforcement.

(C) Student Learning Objective
The student will be able to...
1. Use probability theory to calculate chance.
2. Incorporate knowledge of permutations and combinations to calculate probability.

(D) Materials & Teacher-developed Resources
Smartboard, text resources (examples used specifically in this lesson), Thinking Mathematically, Robert Blitzer, Third Edition, 2005
(E) Learning Activities

(1) Initiation 5-10 minutes

- Warm up exercises distinguishing between permutations and combinations (See Smartboard notes).

- Primary goal is to refresh the students’ prior knowledge and make them comfortable to move forward.

(2) Development 30-40 minutes

- First example is about the probability of certain rock bands performing in designated orders. The students have seen this example as a Permutations exercise three lessons ago. The Fundamental Counting Principle will be applied to this Probability example.

-Extension Activity: The students will have an opportunity to solve a second example at their desks using the methods from the first example. The teacher will be checking their individual work for feedback assessing their skills and success.

-Third example is based on Florida’s Lottery and will solve the probability of winning the LOTTO from purchasing one ticket. This exercise involves Combinations and is a different type of example from the previous two.

-Extension Activity: what is the probability if you purchase 5000 tickets? If you were fortunate enough to have the appropriate resources to purchase all 22,957,480 different combinations of LOTTO tickets; a) How long would it take to input every combination if it takes 30 seconds to input one combination? b) How much should the grand prize amount to in order to make it a lucrative investment? (See post observation reflection for extended thoughts on this activity) The students will work on this activity individually and they will have a chance to confer with their neighbors.

(3) Closure 5 minutes

The closing activity will be to ask the class for the various methods that were used in each example. More specifically, the teacher will ask which methods went with which examples and why. This will be effective because it will summarize what was covered and the students can walk away with a solid foundation of understanding. At this point, the objectives of using probability theory to calculate chance and incorporating knowledge of permutations and combinations to calculate probability will be accomplished.

(F) Evaluation of Student Learning

The students will work on examples from the book on page 591 and 592. Informal evaluation will begin with the understanding of the examples that are presented in the lesson as the teacher is constantly checking for feedback, as well as correct completion of the assigned exercises on page 591 and 592. The teacher is not dictating the entire lesson to the class, rather, he will be asking for volunteers to answer questions throughout the lesson. During the
individual activities, the teacher will be roaming to each student to monitor their progress.

Note the worksheet that is included after the Smartboard notes and its similarity to the quiz. This worksheet was designed to provide a scaffolded study guide that the students can refer to for their quiz. Considering this, there should be a high success rate on the assessments.

Formal evaluation will be a quiz on the Fundamentals of Probability with respect to Permutations, Combinations and the Fundamental Counting Principle that is referenced in this section.

(G) Modifications for Individuals Needing Differentiated Instruction

Two students referenced in the summary are Student A, who has ADD, and Student B, who is a low-level learner in the general education setting. Both of these students will be given extra repetition and practice as well as opportunities for direct feedback and one to one instruction from the teacher during class while they are practicing book examples. As the students continue to practice, I will have opportunities to re-teach the lesson.

Opportunities for extra help and practice are available during and after school and Student A and Student B. Student A has been recommended for both, however, she has not taken advantage of those services to date. Student B has not been recommended for extra help nor has he attended.

The higher-level learners will have opportunities to synthesize their learning with critical thinking and writing in mathematics exercises. Every section of the book contains these types of exercises and once they complete the work that was assigned to the entire class, those students will move on to those higher-level exercises while the other students continue working.