Group 5 Lesson Plan

Level: Grade 10 Math

Number of students: 30

Lesson Specific to this ETEC 530 assignment is on Day 2 of this 3-day Lesson Plan

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Subject/Content: Probability calculations

Instructional Design: 5-stage model of constructivist teaching delivered across three lessons.

Lesson 1: Orientation / Elicitation of Prior Learning / Set up Project Teams
Lesson 2: Group Work (Reconstruction through Two Games)
Lesson 3: Presentations & Feedback / Application / Reflection

Driver & Oldham's stage 1 and stage 2 take place in Lesson 1 (refer Part A; Part B)
Driver & Oldham's stage 3 takes place in Lesson 2 (refer Part C)
Driver & Oldham's stage 4 and stage 5 take place in Lesson 3 (refer Part D; Part E)

Group Learning Approach: Problem Based Learning (PBL)

We have drawn on some important features of the PBL environment stated by Savery and Duffy (1995):

- learners are actively engaged in working on tasks and activities which are authentic to the environment in which they will be used
- learners are constructors of their own knowledge and they construct knowledge in a context which is similar to the context in which they will apply that knowledge
- learners are encouraged and expected to think critically and creatively and to monitor their own understanding at a function and meta-cognitive level
- learners socially negotiate meaning

Learning Outcomes for the 3-day Lesson:

- demonstrate questioning skills and critical thinking (Lessons 1, 2, & 3)
- demonstrate self-directed learning to solve a problem (Lessons 2 & 3)
- demonstrate communication and collaboration to solve a problem (Lessons 1, 2, & 3)
- speak and write the term 'probability' and explain its purpose (Lesson 3)
- perform a probability calculation to answer a question (problem), calculation expressed as a fraction or decimal - accuracy not required (Lesson 2)
- accurately perform a probability calculation to answer a teacher-specified probability task (Lesson 3)
- reflect on learning (Lesson 3)

Prior Knowledge: students not expected to have prior knowledge of probability calculations

Lesson 1 (Day 1): "What is Chance?"

***Part A*. Orientation**
Motivate and orient learners to the topic by clearly stating the purpose of the lesson. The need to give students a clear statement of purpose at the start of the lesson is recommended by Savery & Duffy (1995).

Purpose stated to students: to learn to predict when the 'chances' are 'good' or 'in our favor'

Opening Discussion to frame the purpose: (5 min)
Teacher Question: How many people have a parent who gets grumpy when he/she is hungry? Let's call this getting '*Hangry*' - hungry and angry.

Student discussion: When your parent is 'Hangry' is that a good time to ask them about buying tickets to that concert? or buy you those new jeans/shirt or that cell phone?
Why/why not? - Think/Pair/Share (10 min)

***Part B*. Elicit pre-existing knowledge**

Elicitation activity: 'Four Corners Strategy' (10 min): each corner of the room represents a percentage (1-25, 26-50, 51-75 & 76-100). On a scale of 0 - 100% what are the ***chances*** of your parent saying "Yes" when they are Hangry?

- It is anticipated that most will report a low percentage but some may report a high percentage.
- Volunteers report out to the group.
- The intent is to show students that they already have an understanding of when a situation 'in his/her favor' or 'not'.
- This prior understanding is the foundation from which to build the Probability lesson.
- Students return to their desks once the teacher closes the activity.

Organize groups and set context for Day 2's problem-based group learning:
Teacher poses the question "How do we know the chance of winning lotto?" "What ways can people predict whether they will win the lotto?"

Organize groups by "numbering off 1 - 4". Groups to discuss the questions more comprehensively (there will be 2 groups of 7 and 2 groups of 8).

These groups will remain in place for the upcoming Day 2 and Day 3 lessons.

This part of the Day 1 lesson will situate students into a theme of gambling, the 'meaningful context' for an upcoming, problem-based learning lesson, and enable groups to form and develop rapport.

Reflection/Exit Question: (1-2 min) On a scale of 0 (being low) and 100 (being a guarantee) what are the **'chances'** that you will get homework tonight?

> *(The intent here is to bring closure to Day 1 with a light-hearted question to reaffirm their understanding of chances/gambling but in the real context of their lives - homework. Those who understand the joke will argue '0' and then explain it to those who do not.)*

Lesson 2 (Day 2): Gambling: A game of “chance”?

***Part C*. Restructuring of ideas** (exchanging ideas, constructing new ideas, evaluating new ideas)
Time: 45 minutes

Goal: Understand the probability of a chance situation (gambling)

Objectives:
- The students will be able to determine the number of outcomes related to a given event.
- The students will be able to use the basic laws of probability

Curriculum:
- Use tree diagrams to find the number of outcomes.
- Apply the addition and multiplication principles of counting.
- Find the probability of simple independent events.
- Find the probability of compound independent events.

This is where Savery and Duffy's (1995) problem-based learning comes into play. The teacher can present a problem that will require learners to interact in their groups (same groups organized on Day 1), check each other's knowledge, ask each other questions, and experience cognitive 'puzzlement' (the stimulus for learning).

Activity 1: Will I be married by age 30? (20 minutes)
The teacher could present a problem such as: "I would like you to predict if you will be married by age 30. I'm not going to show you how to answer the question, I want you to work together in your groups, using the resources available, and come up with an answer."

This would be an authentic problem for middle or high school students. Savery and Duffy (1995, p. 4) emphasised that teachers need to design authentic tasks. It would also give learners ownership of the problem solving process (Savery and Duffy, 1995, p. 5)

The teacher then observes the groups in action and scaffolds the inquiry and/or critical thinking needed to solve the problem. The teacher could do the scaffolding by saying own thoughts out loud. "I'm wondering how to approach this question. Is there something I need to know first?"

Then the teacher monitors the four groups discussing what information is required and where/how to get it. This should spark individual reflection and critical thinking, as well as convergent knowledge on the part of the group.

Once learners are showing that they need factual information, the teacher could tell them that last year, the city had a total of **xxx,xxx,xxx** number of people aged 30, and **x** % of those were married. Teacher writes that information in a visible place, e.g. whiteboard. Teacher might say "I'm not going to tell you what to do with that information, I want you to work in your groups to use that information to help you answer the problem." Again, ownership of the process to develop the solution lies with students (Savery & Duffy, 1995, p. 5)

Groups discuss how to use the information provided by the teacher. Meanwhile, the teacher listens to students critically reviewing ideas about math calculations. Teacher scaffolds groups that are off track.

The teacher could give direct feedback to groups about their answer to the problem and their process for calculating the answer, or could ask groups to participate in a class feedback round, where each

group shares to the class as a whole their answer to the problem and how they went about doing the calculation.

Savery & Duffy (1995, p. 9) refer to peer and self-evaluation as useful for problem-based instruction.

Teacher explains to the class that what they have been doing is a "***probability calculation***" and models on a whiteboard how to write 'probability' and how to write the method for calculating probability - showing both the fraction and decimal formats.

Activity 2: Spelling Bee (20 minutes) by Carlton & Mortlock (2012)
Students work in their assigned groups. They read the assignment instructions and complete the game as outlined on their assignment sheet. They are required to collaborate to fill out the worksheet.

Game description**:**
Each group of students are provided with a board with 30 cards on it; 11 of the cards say C, 11 say A, 6 say R, and 2 say CAR. The students each take a turn playing the game and everyone records the outcomes on their data collection sheets.

Method**:** The student picks two cards for free at the beginning of the game. The student can earn up to three additional picks by guessing the prices of small items. If the student's guess is within $10 above or below the actual price of the small item, s/he wins the item and another pick. An exact bid on any of the items wins all three items and all three picks (even if the student did not earn a pick on a previous item). Once the small item bidding is over, the object of the game is to spell the word "car." Each card does have a $500 cash value and the student always has the chance to quit the game and keep the cash shown. If the student spells "car," s/he wins. If the student finds a CAR card, s/he automatically wins.

Learning objectives of this activity**:** Probability by Simulation and Combinations.
Shuffle the 30 *Spelling Bee* cards. Randomly select 5 cards. If you spell "car" or select a CAR card, you win! Each time a student plays the game, record the number of Cs, As, Rs, and CARs selected. Also, record whether or not the student wins the game. Create a worksheet as follows on Page 5 and 6.

Reflection: (5 minutes)

Talk about anything the students noticed during today's games. Bring all worksheets to class tomorrow!

Student Name: _____ **Date:**_____

Other Team Members: _____

_____

Game #	C	A	R	CAR	Win? (y/n)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

- What proportion of the deck of 30 cards are of Cs, As, Rs, and CARs?

Card	C	A	R	CAR
Proportion of the 30 cards				

- What proportion of the cards selected were Cs, As, Rs, and CARs?

Card	C	A	R	CAR
Proportion of your cards				

- Why don't these proportions exactly match the deck?

- How many times did a student win by having a CAR card? What proportion of the time did a student win with this card?

  # times _____ proportion _____

- How many times did a student win by having the 3 cards (C, A and R)? What proportion of the time did a student win with these 3 cards?

times _____ proportion _____

- Pool the class results from all four groups:

  Total # trials _____

  Total times winning a car _____

  # of times won with CAR card _____

  # of times won with the C, A and R cards _____

- Were you more likely to win with the one card (with CAR) or from the 3 cards (C, A and R)?

  Suppose you select 5 of the 30 numbers from the *Spelling Bee* board.

- How many possible groups of 5 numbers could you have? (Hint: Does order matter?)

- Twice in the history of *The Price Is Right*, a contestant has spelled CAR three times with 5 cards: C A R CAR CAR! What is the probability of this amazing event?

- Write out all the different ways you can win *Spelling Bee*. For example, C A R CAR CAR is one way, but so is C C R A C. (Again, keep in mind: Does order matter?)

- Find the probability of each of these options.

- Add up your answers above to find the probability of winning *Spelling Bee*.

  Bonus activity: Find the probability of winning *Spelling Bee* if you only select 4 of the 30 numbers.

Lesson 3 (Day 3): Testing Probability Calculation Skills

***Part D*. Application of ideas** (use ideas developed in familiar and novel situations)

Self-directed group-based activity: Students are asked to work in their groups and come up with some questions about things they might like to predict about the future. They work individually or collaboratively to solve those questions, and check each other's probability calculations. Teacher monitors groups and provides input if there are issues with accuracy with probability calculations ('guide on the side').

It is intended that students apply what they learned in Day 2 to problems that are meaningful for them, and that their group work is self-directed.

***Part E*. Review**

Reflection Activity (Individual Task): Teacher asks learners to reflect on how they answered the question at the start of the lesson ("What is the chance of winning Lotto?") and how they would answer it now. They are asked to work by themselves and write down what they have learned about probability and what they have learned about working with others to solve problems. Savery and Duffy (1995, p. 6) claim instruction needs to support reflection of both the content learned and the learning process.
This reflection activity gives students a list a prompts that they can use as a jumping off point to "Say Something" about what they learned – the next activity.

"Say Something" Activity: Students are asked to share their reflection with others (pair/group). Teacher provides prompts for the sharing and writes them on the whiteboard.

Prompts:
Based on what I have seen, I predict…
- I'm unsure/unclear/wonder about…
- At first I was a bit confused by … but then …
- It seems to me…
- After watching/listening to others, I realized…

Justification for Group 5's Lesson Design

"Learning theory may indicate *how* something should be taught, but *what* and *how much* should be taught to *whom* follow from different or additional considerations" (Matthews, 1994). We need more than just a theory of constructivist learning, we need a model for constructivist instruction. Hence, Driver & Oldham's 5 steps or stages of constructivist teaching are a helpful model to design a lesson on probability (Sunal, n.d.). The lesson design was based on those 5 steps, indicated by **Part A, Part B, Part C, Part D and Part E.**

Savery & Duffy's (1995) instructional model and constructivist framework for problem-based learning is also useful to design the lesson. "What we understand is a function of the content, the context, the activity of the learner" (Savery & Duffy, 1995). The lesson design above is based on their framework for problem-based learning which in itself is based on Lebow's (1993) seven primary values of constructivism (cited in Savery & Duffy, 1995).

Importantly, the lesson focuses on activities, or 'learn by doing'. As stated by Matthews (1994), "The curriculum is not seen as a body of knowledge or skills but the program of activities from which such knowledge or skills can possibly be acquired or constructed".

References

Carlton, M. & Mortlock, M. (2012). Let's Make a Deal! Probability and Statistics Through Game Shows. Cal Poly State University: San Luis Obispo. Retrieved from http://statweb.calpoly.edu/mcarlton/gameshows/index.html

Casteel, M. Amirjalayer, S., Davis, D. and Simmons, J. (n.d.). EMAT 6680 Course Project: Grade 8 and 9 Probability in Real Life Unit. Retrieved from http://jwilson.coe.uga.edu/EMAT6680/Simmons/untitled%20folder/6690%20Detail%20Lesson%20Plans.pdf

Matthews, M. R. (1994). Chapter 7: Constructivism in science and mathematics education. *Science Teaching*. New York: Routledge. Retrieved 21 May 2012 at http://www.csi.unian.it/educa/inglese/matthews.html

Savery, J. R., Duffy, T. M. (1995). Problem Based Learning: An Instructional Model and Its Constructivist Framework. *Educational Technology*, 35 (5), p. 31-38. duffy_publ6.pdf

Sunal, D. W (n.d.) The Learning Cycle: A Comparison of Models of Strategies for Conceptual Reconstruction: A Review of the Literature. Retrieved October 9, 2010, from http://astlc.ua.edu/ScienceInElem&MiddleSchool/565LearningCycle-ComparingModels.htm