Formative Assessment lesson planning template

Unit: Probability (7th Grade)

Standard/Performance Expectation(s) : Determine the theoretical probability of a particular event and use theoretical probability to predict experimental outcomes. [7.4.B]

Building Block Objective/Learning Target : I understand why the more times I perform an experiment the closer my overall results get to the predicted probability.

Communication Technique: The teacher will start the class out with a review of the last few days' work and then explain the learning target and success criteria to the students.

Common Misconceptions:

- Students may confuse experimental and theoretical probabilities.
- Students may predict experimental outcomes for a large number of trials based upon a too-small sample size.
- Students may believe that an error has occurred if their experimental results do not *exactly* match their theoretical predictions.

Elicitation Activity*: The students will be performing a probability experiment in pairs using spinners. Students will record and aggregate their data and analyze their results.

Topic introduction/lesson Activities: REMEMBER TO GO OVER LEARNING TARGET

Class will start with a group brainstorming where the students are encouraged to recall any vocabulary they remember from the unit. Students will be prompted to define the terms other students bring up and then the class as a whole will refine those terms into a definition everyone (including the teacher) can agree upon. During this activity the teacher's job will be to prompt students for more information and ask probing questions that can fine tune students' definitions of concepts.

The class will then be split into pairs and each group will be given a four-area spinner and a data sheet. The teacher will explain the mechanics of the spinner and what to do if it lands on the border between two colors (if you can't agree on which color it landed on, spin again). Students will then be asked "What is the theoretical probability of getting red? Why? Students should discuss these questions together until they can agree upon an answer and they are both ready to share their answer if called upon to do so. The teacher should call upon a couple groups and try to remain neutral to the quality of answers given so that the students are free to share any other answers they may have that don't agree with their peers.

Next each group will be asked to predict how many reds they'll get if they spin 10 times and write it down on their paper. Again, the teachers will call on groups to share and justify their predictions.

Each pair of students will spin 10 times and record all their spins on the data sheet. Before the groups are allowed to compare answers, the teacher will ask, "How many reds do you think the class spun altogether?" Students will agree upon an answer in pairs and be ready to share out when called upon and justify their answers.

While the students are discussing their whole class depictions, the teacher will bring up the Excel Spreadsheet projector and prepare to enter students' data.

In order to aggregate their data, the teacher will ask for each group's data in order from most reds to least reds and refresh a pie chart of the data in between each group. Student should be invited to comment on the overall appearance of the pie chart as data is gathered. After all the groups are recorded the teacher will elicit summaries of the data from the students. "Are each of the four areas the same size? Why do you think this is or isn't?" When (if) and student points out the resemblance to the spinner ask the class why this is the case. Ask the class what might change if each group spun 10 more times and we recorded the data again, adding it to our existing data.

What happens for the rest of the lesson will depend upon how much time there is in the period at this point. It is imperative to leave time for reflection and formative assessment at the end of the period. If there is time for another round of spinning and recording, still accounting for reflection time, then this should be done. If there isn't enough time, then the teacher will move into the formative assessment question, which is detailed more below.

Formative Task or question: Students are given a ½ sheet with the question: "Sally flips a coin 10 times and gets 3 Heads and 7 Tails. If she continues to flip the coin until she has flipped it a total of 100 times, how many heads do you think she'll end up with out of those 100 tosses? Write a few sentences to explain your answer."

Formative Technique: This question is designed as either an exit slip or as a prompt to a class discussion depending on how much time is remaining in class. Either way the students should hand their slips back to the teacher as soon as they are completed. If there is time left in the class the teacher should ask the students for answers (without justification first), then after all the answers have been elicited, the teacher can ask for justification. Afterwards the students can be asked if they would like to withdraw or further defend their answers.

Possible answers and justifications include (in order from best possible answer down):

48 heads. The student understands that there are 90 more tosses, half of which should turn up heads. These 45 heads are added to the previous 3 heads.

50 heads. The student understands that the theoretically most likely scenario in 100 tosses is 50 heads, but has failed to account for the bias in the first ten tosses.

30 heads. This student is likely inappropriately using proportional reasoning. It is also possible that they concluded that the coin is biased and is only 30% likely to grant a head. This might be a good teachable moment for a discussion on sample sizes. Ten tosses are probably not enough to conclude that a coin is unfair. Get the students to come to this conclusion if possible. Don't just tell them.

Adjustment Trigger *What level of student performance will necessitate an instructional adjustment?*	Less than 85% of the students have justified an answer around 48 or 50.

Instructional Adjustment (if needed): As mentioned above a class discussion on sample-size might be necessary at this point. Also, on the next day the teacher should work through the example given in class. Explain that why 48 is the best possible answer, but that 50 is close. Answers around this number are also pretty good, but not quite as likely to be right. Explain that because of the randomness involved experimental probability does not always behave proportionally, as theoretical probability does. Give the students a similar exercise involving a spinner or die.

Lesson Closure*: Refer the class back to the learning target and ask them how the day's activity (spinning and aggregating data) relates to the learning target of understanding how experimental data will approximate theoretical data with enough repetitions.

* Opportunity for formative assessment