Mathematical Vocabulary & Representations

> What are the key mathematical words and phrases my students will need to understand and use in my learning segment?

In a middle-grades probability unit, for example, those vocabulary words might include: chance, probability, odds, possible, likely, unlikely, probable, impossible, certain, fair, outcomes and events, "equally likely outcomes," "and," "or," organized list, tree diagram, area model, simulation, experimental and theoretical probability, independent and dependent events, expected value, average, combinations, permutations, "order matters", "on average," "in the long run,"etc.

> Which of these words/phrases will be new to my students?

For example, I might anticipate that my 7th-graders students could already identify outcomes as impossible to certain and compare them as more or less probable. (Of course I would likely still assess that.) I would assume that "independent events" and "dependent events" would be new terms.

> Which of these words/phrases have different meanings in informal/non-mathematical conversations?

For example, certain means something very specific mathematically. It means that the probability of that outcome is 100%. In informal English, we often use certain to represent an outcome that is very likely. Mathematically you wouldn't describe a probability of 90% as "90% certain," but we say things like that all the time in informal English.

Random and combination also mean something very specific mathematically.

Consider also "tree diagram." They look very little like trees, because they start out small at the top and then get bigger as they go down. They should really be called "root" diagrams? Silly.

> What are "kid-friendly" ways of describing each of these?

> Which new mathematical representations (including notation) will students need to learn to "read" and use in my learning segment?

For example, the notation "P (6)" could be read as "The probability that the outcome will be 6." Students, depending on their age, may also need to read and/or construct notation such as "P (A ∩ B)" as "the probability that events A and B both occur." There are countless other examples.

> What "non-mathematical" words or phrases will my students need to understand in order to make sense of the task scenarios in my learning segment.

For example, almost every probability unit involves "real-world" tasks that come with their own set of vocabulary: dice ("die" is a fun word!), spinners, counters, "free-throws," etc. Many of these may be unfamiliar to students.

Many probability activities also involve other mathematical terms (e.g., "Find the probability that you will roll an even number" or "Determine the probability that you will roll a multiple of 3.") These are mathematical terms that students would need to understand in order to be successful on those tasks, but are likely not new vocabulary phrases for this unit.

Genre (i.e., Purpose) and Linguistic Features

> How (i.e., for what purpose) will students be using language in your learning segment?

In a probability unit, for example, students are likely to need to compare or order probabilities (e.g., say

which is "more likely"), to justify & persuade (e.g., to persuade the audience that a game is unfair), and to solve problems (e.g., to recount the steps they took to calculate a probability.

> Which key words/phrases will my students need to understand in order to follow directions during this learning segment, and which of these will be new to my students?

They will likely need to be able to follow probability-specific directions such as: "Determine the probability of…", "Determine which is more likely…" "Compare the probabilities of…" "Determine whether the situation is fair", as well as more generic directions such as "Represent this situation…", "Justify your solution…" and "Explain your reasoning." I would have, ideally, have already unpacked some of these (e.g., "Explain your reasoning") in an earlier unit.

Although this is still vocab, I tend to put it here rather than above, because I think the words in directions are easy to generate alongside the genres – these really signal what those genres are.

The challenge for my students here is to narrow their focus, particularly if they're working with ELL students. I don't want them to do everything at once – they need to pick something on which to work.

> Write some sentences (to develop into sentence frames) that capture how you expect students to be using academic language to achieve a particular purpose during the learning segment.

Some examples:

Explaining how you calculated a probability: The probability that, if I roll a die, the outcome will be even, is 1/2. That is because there are 6 total possible outcomes, each of which are equally likely [1, 2, 3, 4, 5, 6,], and three of those outcomes are even [2, 4, 6]. The probability is therefore three out of six, or 3/6, which is equivalent to ½.

> The probability that describe the scenario, the describe the desired outcome will be give the probability. That is because…

Comparing a probability: If you roll one die, it is equally likely that the outcome will be even as odd. That is because there are six total possible outcomes, each of which are equally likely [1, 2, 3, 4, 5, 6,]. There are the same number of odd and even outcomes, so the probability is the same.

> If you <u>describe the scenario,</u> it is <u>more, less, equally</u> that the _____. That is because…

Some things to know:

1. I used probability, which is an admittedly language-heavy unit. I think that helps make the point that learning math is entirely wrapped up in learning language, but it's might be kind of an extreme case, in case someone points that out to you.

2. As for language supports:

-- I'm encouraging sentence frames, particularly with the elementary. I'm not sure any of my candidates are actually using them in their teaching, but I do think they help in preparing to teach a learning segment.

-- What I tend to emphasize as supports are: (1) connecting oral language to visual representations (e.g., pointing to elements of a graph on the board as you're talking about it, using gestures); (2) "revoicing" students' contributions using slightly more academic language, and double-speaking (i.e., saying it using both academic and non-academic language). with the assumption that you will be developing academic language OVER TIME -i.e., you don't expect them to use the academic phrases right away - and that's okay; (3) using and encouraging kids to use "technical writing tools" to justify thinking, including color, arrows, labels, etc., in addition to language; (4) giving them opportunitites to communicate their thinking in pairs or groups, rather than always in whole class; (5) and being precise about their referents when they're explaining something (i.e., try to avoid "this" and "that", and instead name the thing they're mentioning.