**Total Time needed 60 minutes**

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| **Handouts:**   * Flipping Coins Task | **Materials:**   * TI-Navigator * TI-Nspires * ***Flipping Coins StaRT.tns*** * Nspire QuickPoll documents ready to go. |

**Objectives**

The students will confront misconceptions concerning short term, observable probabilities. They will explain the role of sample size in determining the key features of a sampling distribution and will use these features to make probability-based decisions.

**Introduction (10 minutes)**

Send the Nspire file to the students and ask them to read page 1.2 and answer question 1. Perform a quickpoll to determine their choice. Lead the students in a discussion to elicit their conceptions and misconceptions.

*Shelly is going to flip a coin 50 times and record the percentage of heads she gets. Her friend Diane is going to flip a coin 10 times and record the percentage of heads she gets.*

1. *Which person do you think is more likely to get 20% or fewer heads? Explain the reasoning behind your choice.*

Anticipated responses

* Some students will not understand the question.
* Some students will pick 50 times because they think that more flips will give them more opportunity for things like this to happen.
* Some students will correctly think that you should be closer to 50/50 with a larger sample size.

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**Part 1 (10 minutes)**

Tell the student to move on to page 1.3 and answer the question. After they have ***written a response*** to question 2, they may move to pages 1.4 and 1.5 to continue the investigation.

*To help you answer this question, we need to look at the “typical variability” from random sample to random sample. We expect around half of the coin tosses to be heads, but not all samples will have exactly 50% heads.*

1. *How far from 50% heads do samples typically vary?*

Anticipated responses

* Students are likely to give answers in terms of actual number of heads instead of proportions.
* They may disregard the role of sample size and say things like “It could be off by two or three heads.”

It is important that the write an answer so that they can confront their misconceptions after viewing the sampling distribution.

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**Part 2 (20 minutes)**

Next, the students will view the effects of changing sampling size on the shape, center, and spread of the sampling distribution by entering various sample sizes into the program on page 1.5. Tech tips are provided, but it may be necessary to demonstrate how to make changes to the program.

*On page 1.5, the TI-Nspire will find the percent of heads in each of 100 samples of the size you put in parentheses and display them in a plot. These plots are referred to as approximate sampling distributions. Explore with this program using different sample sizes.*

1. *What conjectures can you make about the effect of changing sample size on the sampling distribution?*

Anticipated responses

* As sample size increases, the variability of the sampling distribution decreases, the shape becomes more normal, but the center remains the same.
* The approximate sampling distributions are slightly different even when the same samples sizes are being used.
* They might switch to histograms.

After the class has had an opportunity to make conjectures, send a **QUICKPOLL** to capture one conjecture per student. Lead a discussion pertaining to the validity of these conjectures. In particular, ask students if they can find counterexamples or if they support the conjectures.

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**Part 3 (20 minutes)**

Students should advance to the final page and answer question 4. They should use their conjectures from number 3 to support their decisions.

*Now, let's revisit the original question.*

*Shelly is going to flip a coin 50 times and record the percentage of heads she gets. Her friend Diane is going to flip a coin 10 times and record the percentage of heads she gets. Which person is more likely to get 20% or fewer heads?*

1. *Has your answer changed? Explain how the sampling distributions support your current answer to the question.*

Randomly select student to begin discussion. If disagreements occur, put someone **LARGE AND IN CHARGE**and direct them to the sampling distribution program.

**Total Time needed 60 minutes**