

The Mushroom Experiment Lesson Plan

About This Lesson:

This lesson is intended to teach core statistical concepts to students in junior high or high school. In this lesson the students run an experiment, then build a histogram showing the results of the experiment. The students then run the experiment again and compare the results of the two experiments. It is possible to teach this lesson in one class period, although you may choose to cover part one of this lesson one day, and part two the next day. This lesson is set up to accommodate up to 25 students.

The main concepts covered in this lesson are histogram and distribution. Many other statistical concepts can be woven into the lesson. This lesson can be customized to match the level of your students. If your students are more advanced you may want to use this lesson to teach or review other statistical concepts such as frequency, intervals, outlier, normal distributions, mean, standard deviation, hypothesis, variation / variability / dispersion, and population.

This should not be the first lesson taught using MinecraftEdu. Students must be familiar with moving around inside of Minecraft and placing blocks before participating in this lesson. This lesson requires the students to switch their attention between the Minecraft world and your statistics lecture.

Lesson Overview:

- The students enter the world and look at the example histograms.
- Begin the lecture by having the students make observations about the example histograms. Review key vocabulary.
- Explain the experiment to the students. They have to collect as many mushrooms as they can in four minutes. They each have their own island to collect mushrooms on.
- Line the students up next to the portals, one portal per student. Begin the timer and turn on student building. The students break through the fences and each warp to an island.
- After four minutes turn off student building. Warp the students back to the area with the histograms.
- The students build a set of histograms using blocks.
- Review key concepts and vocabulary.
- In part 2 the students run the experiment again. The world will need to be reloaded to reset the mushrooms on all of the islands. The students will have to re-join the server once the world has been reloaded. The students will be kicked out of the MinecraftEdu world between part one and two. This is the most logical place to break this lesson into two class sessions if you feel you will not have enough time to cover everything in one lesson.
- Run the experiment a second time.
- The students will then build another set of histograms.
- Put the screenshot you took of the results of the first experiment up on the projector. Compare the results of experiment one and two and talk about differences in the histograms.

Set Up and Tips:

After loading the Mushroom Experiment MinecraftEdu world, turn off student building. You will turn it back on when you are ready to run the experiment. Make sure that night and weather are also turned off.

Make sure you have turned on creative mode for yourself. This will allow you to fly. Turn on long distance building so you can easily add or remove blocks and ladders. Put ladders and obsidian in your inventory so that they are readily available to you when you are teaching the lesson.

As students enter the world they will spawn next to two histograms. The histograms represent the heights of male and females. Let the students run around and investigate the histograms as the other students join the world.



A projector is needed when teaching this lesson. Letting the kids see your screen is useful for pointing out specific parts of a histogram. At the end of part two of this lesson, you will be comparing screenshots of the histograms the students have built and talking about the differences between them.

Make sure you know how to take a screenshot before beginning this lesson. To take a screenshot on a PC, press printscreen and then paste the screen into Microsoft Paint. See this link for more detailed instructions (<http://www.wikihow.com/Take-a-Screenshot-in-Microsoft-Windows>) . To take a screenshot on a Mac, press Command + Shift + 3 (all at the same time) and a

screenshot will be saved to your desktop.

Freezing students while giving parts of the lecture may increase the students attention to the lecture. Freeze them for a few moments at a time when covering the main points of the lecture. For instance, freeze the students when going over the aims of the experiments, before you have them place a block to represent the number of mushrooms they collected, and when reviewing the key points of the lesson.

Lesson - Part 1A:

The students enter MinecraftEdu and spawn in an area with two histograms. The students can check out the histograms built out of blocks while waiting for their classmates to join the world.

When all students are in the world, freeze them all. Review **Histograms**. Use the first part of this lesson to make sure that your students understand what a histogram is, and how to read a histogram.

Ask students when you begin - "Make an observation about this set of data represented by blue and yellow blocks".

Concepts to review:

- Talk about why the distributions are shaped the way they are.
- Review that frequency frequency is shown on the y (vertical) axis and intervals are shown on the x (horizontal) axis. Talk about why x axis data is separated into classes and why the stacks are called "bins".
- Talk about how the rectangles of a histogram are drawn so that they touch each other to indicate that the original variable is continuous.

Tell your students - "We are going to answer a statistical question - How many mushrooms will the students in this class collect in four minutes?"

Lesson - Part 1B:

The students will now run the experiment. They have four minutes to collect as many mushrooms as they can. Have the students line up in the gates by the portals.

Tell your students - "When I say go, you will punch through the fence separating you from the portal block in front of you. Run over the portal and you will be warped to your own mushroom island. You will have four minutes to collect as many mushrooms as you can!"

Make sure that each student is at their own gate. Turn on student building and start the clock. Tell your students to punch the fence in front of them and run through the portal. This will warp each student to their own island where they will collect red and brown mushrooms.

While the students are collecting mushrooms, close off all of the gates leading to the portal

blocks. This is to make sure that when you warp the students back to the area with the histograms they don't just warp themselves back to the islands. Use the teacher tools included in MinecraftEdu to do this quickly.

If students have technical issues when they warp, have them re-load the world. Sometimes the world doesn't load the islands fast enough and the students fall through the ground. Having the student exit the world and re-load the world should take care of this issue.

Give your students a one minute, thirty second, and ten second warning as the clock counts to four minutes. Turn off student building at end of the four minutes. While hovering above the concrete area with the histograms, use the teacher controls to warp the students to you. Be sure to turn off student building before you warp the students back to the starting area so they cannot destroy the example histograms.

Lesson - Part 1C:

After the four minutes are up and student building has been turned off, use the teacher command "Warp all Students to me" to warp all students to the stone area where the histograms are being built.

Note that there are three areas where the students will be building histograms. The blocks with green circles are build allow blocks, a special MinecraftEdu block that allows students to build on top of them even when you have disabled student building. One of the areas with the build allow blocks is for the total number of mushrooms collected. The other two areas are for observations of number of red mushrooms collected and brown mushrooms collected.



Note that there is bug with the large signs. Anything you type on the signs will be gone the next time you load the world. Before the lesson you may want to label the signs “Number of Mushrooms Total”, “Number of Red Mushrooms”, and “Number of Brown Mushrooms”. The total mushrooms histogram should go on the longer line closest to the islands.

Tell your students - “We are going to build a histogram representing our results of the data. I’m going to give you a Minecraft block to place at the correct place on this line of values. Put the block on the line at the place that represents the total number of mushrooms you collected. The frequency of the data is mapped to the vertical (y) axis. This means that for each observation of collected mushrooms in a bin, the bin will grow taller. You will probably have to climb up the stack to get to the top to place your block, use the ladders I am putting on the sides of the blocks. Only place the one block I give you, and make sure you place it at the correct place on the line. You won’t be able to destroy any blocks once they are placed so place them carefully. Hold onto the mushrooms you collected, you will need them. We are placing the blocks on *this* line (point to the green blocks closest to the islands). We will be using the other two green lines in a moment”.

Use the “Give” menu to give all students one block of obsidian. Obsidian is used because it cannot be destroyed by the students. If a student makes a mistake and places their block of obsidian in the incorrect place, you will have to destroy it yourself and give that student another block of obsidian to place. Use the teacher tools to place ladders on the blocks as they are placed so students can climb up to place their block on top.

Have the students place their block on the timeline at the value that corresponds to their result in the experiment. You will see a distribution began to form as the students place their blocks. After they have built a distribution representing the total number of mushrooms collected, have the students build another distribution representing the total number of red mushrooms. Do this again for brown mushrooms. At this point all three lines will have distributions.



Lesson - Part 1D:

Once everyone has placed their block review the histogram:

- Talk about the distribution of the histogram.
- Review mean and standard deviation.
- Look at the data. Are there any outliers?
- Review normal distributions and all of the different types of data that form normal distributions.
- Review any other concepts that you want to cover at this point in the lesson.

Take a screenshot of this first set of histograms that the students have built. Because you will be running the experiment again it is important to have a picture of the first histograms to compare to the histograms the students will build in the second part of this lesson. Make sure you rename the screenshots to something appropriate and save them so you will be able to find them later.

Stop the server. This will kick everyone out of the world. It is a good idea to save a copy of the world so you can load it up later to look at what the students did. Make sure to rename the save file so that you don't overwrite the original world. If you overwrite the original Mushroom Experiment world you will have to re-download it to run part two of this lesson.

Lesson - Part 2:

Tell the students that they will run the experiment again. Ask them to make a hypothesis about what will happen when they run the experiment again. Will the peak of the data move right, left, or stay the same? Why? Will the variance go up or down? Will there be more outliers than before?

Repeat all of the steps in part 1. The students will build three histograms just as before. Put the screenshot you took of the first set of histograms up on the projector so that the students can see the current histograms and the histograms from part one at the same time.

Have your students make observations about the difference between the first histogram and the second that the students made. Talk about if their hypothesis was correct and possible reasons why or why not. Ask them if the mean (peak) greater or less than before. Did the mean move left or right compared to the first histogram? What changed about standard deviation (spread) between the two distributions?

Review the two sets of histograms:

- Review variance. Observe the differences in the variance between the two sets of histograms.
- Talk about standard deviation, and how standard deviation is a measure of variance.
- Review population and how statistical inferences can be drawn about populations.
- Review random sampling and how it related to the current experiment. Would kids in other schools get similar results if they ran this experiment? What about kids in other grades?

Take a screenshot of the second set of histograms and save it with your first screenshot. If you decide to save the final world, make sure to give it a unique name.



Resources:

Standard Deviation - <http://easycalculation.com/statistics/standard-deviation.php>

Histogram - <http://en.wikipedia.org/wiki/Histogram>

Normal Distribution - http://en.wikipedia.org/wiki/Normal_distribution

Normal Distribution - <http://www.experiment-resources.com/normal-probability-distribution.html>

If you have any questions or comments on this lesson, please contact me at the information provided below.

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