Manufacturing Engineering Demonstration

Takes only about 20 minutes, depending on the amount of discussion.

Purpose:

Demonstrate the concepts used by a manufacturing engineer in determining the best layout for a fabricator.

Supplies:

A couple of big bags of Skittles candy, separated by colors (5 colors minimum). You could use M&Ms instead of Skittles, but I think Skittles hold up better.

Plastic baggies (You will need quite a few, particularly if you have several sessions and don't have time to re-separate the candy between. You end up with a lot of partially stuffed bags).

Set-up:

Write on the board so everyone can see (or on a paper posted where everyone can see):

3 of color A
1 of color B
2 of color C
1 of color D
2 of color E

Where A is the color that you have the most Skittles of, C & E are two colors that you have a lot of, and B & E are the colors you have the least of.

Have one student sit at the front of the room with all the color A Skittles. On the other side of the room, have a student with the color B Skittles. Somewhere far away from the B student, put the color C student. Then similarly for D & E. The point is to have it be very inefficient to go in the defined order from one student to the next.

Designate 2 students as quality control. They will be the 'end of the line'. The rest can be 'runners'. They should be positioned at a table with the baggies. If you have much more than 14 students, it would be good to have another color of Skittles (or to have some folks watch, rather than to have too many runners). With less that 11, you may want to drop to 1 quality control and/or cut back on one color.

The Exercise:

Explain to the students that they are a production line whose purpose is to stuff baggies full of the correct mix of each color of Skittles as written on the board. Here's how it works: The first runner takes a baggie from the front and brings it to the color A station. At that station, the student holding that color is allowed to transfer 3 Skittles one-at-a-time into the bag (the runner is only there to transfer the bag from one station to the next). The runner can then take the bag to the color B station and so on. The next runner can't start to go to station A until the previous runner has left that station. The runners bring the completed bags to quality control, where they count each color and make sure it matches the list (the runner can then go back to the starting line for another run). Give them 2 minutes to see how many correct baggies they get through quality control.

After counting the bags, ask the students what could be done differently to make things more efficient. Examples that are usually brought up: position the color stations next to each other in order, eliminate the runners and have the color stations pass the bags directly to the next station with QC as the last station (or I've seen one class keep the runners, but the stations never handled the bags and simply dropped in their Skittles as the bag was walked down the line), allow the students at the stations to put more than one color in the bag at a time, maybe have two of the color A stations, etc. Implement their ideas and have them run the exercise again, this time giving them only 1 minute. In past experience, we've seen them get twice as many bags completed in the one minute than they had been able to do in two minutes before for a 4x improvement.

The Conclusion:

I use this exercise to explain that these questions are similar to what engineers in a manufacturing facility deal with all the time: how many of each type of tool do they need so there are no bottle-necks, how to lay out the tools in the facility to have the path be the most efficient, how do we transfer product from one station to the next, etc. Other similar questions would be: can any of the tools be used for more than one process (station), how do we get the most efficiency for the least amount of cost (e.g., you could have multiples of every station), what do you do if a tool breaks down (do you have back-ups? Where do you stop production?), how do you make sure each station has enough materials, etc. The goal of manufacturing is to get as much good product out the door as they can in a set amount of time (the more product per day, the more profit from the investment in the tools/building/infrastructure).