Manufacturing Computers
Grades: 6-8
Topics: Algebra, Manufacturing Efficiency

Big Ideas:

- Assembly lines allow for increased manufacturing output.
- Increased output does not necessarily mean increased productivity.
- Careful management of employee scheduling can increase the productivity of an assembly line.

Concepts:

1. When you compare productivity you must compare similar units. (i.e. you must measure the computers produced per person, not simply the number of computers produced).

Objectives:

1. Students will compare the total output produced by an individual completing a task to that of a team on an assembly line.
2. Students will articulate why simply comparing the total output of the team versus the individual is not an accurate measure of productivity.
3. Students will suggest measures that could improve the efficiency of an assembly line.

Vocabulary: Assembly Line, Productivity, Efficiency, Manufacturing

Essential Questions:

1. Why is it an inaccurate measure of productivity to simply compare the total number of computers produced by an individual to the total number produced by a team on an assembly line?
2. What are some things that can be done to improve the productivity/efficiency of an assembly line?

Lesson:

1. Watch the video *Manufacturing Computers*
2. Complete the *Marzano Vocabulary Sheet* for the term *assembly line*.
3. Hand out the *Time of Production per Task* sheet.
4. Compare the production of one worker versus ten on an assembly line.
    a. How do they compare for each task?
    b. Who would produce more computers in an hour, the ten-person line or the individual?
    c. For each person on the line how many computers were produced each hour?
5. Ask the students how it is possible that an individual could produce more computers per person in an hour than the ten members of the assembly line, particularly since the specialized workers of the assembly line are able to complete each task much quicker.
6. Point out that the key term is "per person." Point out to the students that on the sheet there is only one person allocated per task on the assembly line. This means that the fastest a computer can be built is longer than the 7 minutes it takes to build the most difficult part. While the Micro Processer is being finished, all of the other workers are doing nothing or they are building parts for computers that cannot be finished yet.
7. Explain the meaning of the word, "Productivity." (The amount of something produced by an individual person during a set period of time.)
8. Ask the students what a company could do to cut down the seven minutes that it takes to build a micro processor so that the other workers don't have to sit and wait around. (Hire more people to build micro processors.)
9. Ask the students how else companies might improve the efficiency of an assembly line. (1. Cut down wait time, 2. Cut down time between tasks, 3. Train to improve speed of completing a task, 4. Eliminate steps of production, etc.)
10. Tell the students that they will be doing a computer simulation to measure how efficient they would be at managing an assembly line.
11. Have the students move to the computers and log into the simulation.
12. Model how to place inputs into the simulation and interpret the results. Make sure to emphasize to the students that if they add a worker to a station unnecessarily that this will make the line less efficient (people will be working to complete tasks that are being completed plenty fast while others are falling further behind on the tasks that take a long time.)
13. Have the students use the simulation to schedule workers and improve their CPH number.
14. Once students have completed the simulation have them report their most efficient number to the class (How many employees at each station and CPH number).
15. Work with the students to show the mathematics that the computer used to calculate productivity (Number of computers produced each hour ÷ number of people building computers). Challenge students to find places where there are redundancies in scheduling that hurt productivity. Challenge students to find places where more workers could be added to improve efficiency.
16. As a closing activity or for homework have the students complete the essential questions sheet.

Marzano Vocabulary Sheet: **Name: _____**

Assembly Line

Write a definition in your own words:

Draw a picture of the word:

Use the word in a sentence:

Rate how well you understand the word:

1	2	3	4	5
Not at all	a little	okay	pretty well	I can teach somebody else

Essential Questions Sheet: Name: _____

1. On the ***Time of Production Per Task*** sheet we concluded that even though the assembly line team could make a lot more computers in an hour than an individual, the individual was more productive. How is this possible?

_____

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2. What are some ways that the productivity/efficiency of an assembly line can be improved?

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3. Explain a situation where adding a worker to an assembly line would actually make it less productive.

_____

_____

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_____

Schedule workers for each task in order to maximize the number of computers made per person each hour. (CPH)

Name(s): _____
_____
_____

Trial 1:

Time of Production Per Task	Time needed to produce components, 1 person	Time needed to produce components, 1 person per task	Workers used	Minutes to produce 1 component
Micro Processor[1]	13 minutes	7 minutes		
Memory Board[2]	9 minutes	4 minutes		
Drive Controllers[3]	8 minutes	4 minutes		
Motherboard[4]	6 minutes	2.5 minutes		
Power Supply[5]	5 minutes	2 minutes		
Hard Drive[6]	4 minutes	1.25 minutes		
CD ROM Drive[7]	3 minutes	1 minutes		
Floppy Drive[8]	2 minute	.5 minutes		
Monitor[9]	2 minute	.5 minutes		
Package[10]	3 minutes	1.25 minutes		
Total Time to Produce 1 Computer	55 minutes	7 minutes		
People used to Produce 1 Computer	1	10		
CPH (Computers per person per Hour) = 60min ÷ min ÷ #people	60 ÷ 55 ÷ 1 = 1.09	60 ÷ 7 ÷ 10 = .857		

Explain how you reached your CPH number:

_____

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