"Leveling Up" In Your Favorite Video Game Math Modeling Activity (Middle School)

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"LEVELING UP" IN YOUR FAVORITE VIDEO GAME MATH MODELING ACTIVITY

Setting
Two friends both like to play the same video game; however, one person got the video game a week before the other. In order to play the game together they need to be on the same level.

Task
Using the video game information given, determine how many days it will take the player starting a week later to catch up to the level their friend is at and give a visual representation of your model.

Math Objective
The students will write linear equations that represent their situations and determine the intersection of their lines. The students will also graph their equations and discuss potential flaws in this model. **Eighth grade mathematics**

Grade 8 Tennessee Mathematics Standards Used

Expression and Equations 8: **Students will analyze and solve pairs of simultaneous linear equations.**
a) Understand that solutions to a system of two linear equations in two variables corresponds to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
b) Solve systems of two linear equations in two variables algebraically and estimate solutions by graphing the equations.
c) Solve real-world and mathematical problems leading to two linear equations in two variables.

<u>Desired Progression</u>

Begin by putting students in pairs and have them choose their favorite video game and pass out. With the given information the students will do the following:

(1) Determine, based on their daily schedule, on average, how much time they have per day to play.

(2) Determine how many levels they can gain in a day.

(3) Once they have determined how many levels they can gain per day, assume the slower player obtained the game first.

(4) Calculuate what level the student who began a week early is at, when the second student gets the game.

(5) Write equations that model the progress of their experience level.

(6) Determine where these equations are equal and what level this happens at.

(7) Give a represenation for their model.

<u>Instructional Plan</u>

Begin by putting students in pairs and have them choose their favorite video game. Pass out the information sheet on video games that has how many hours it takes to level up in each game provided by different online users. Ask the students to determine how much time per day they are able to alot to playing the video game and brainstorm how they can use the information provided to figure out how many levels they can increase per day. Walk around the room and monitor what the students come up with. Ask students what assumptions they are making and what the number they come up with represents.
Here are some assumptions and questions you may choose to ask the class:
We need to assume that players are of the same skill level We need to assume that you play the same amount every day
We need to assume that it takes the same amount of time to move up a level
Does the video game have a maximum level?
What happens if the player who plays less per day started a week late?

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After they have determined their levels per day rate, instruct them to let the player who plays less per day be the one who gets the game first. Tell them they will be asked to consider this assumption at the end of the lesson. We wish the students to write equations to model the progression of each of their experience level. So, ask them how they can use the information they now have and lessons learned in class to model the desired situation. Monitor and ask guiding question such as:

Teacher: *"How do we mathematically express rates like our level per day in this situation"*
Student: *"Umm I think equations"*
Teacher: *"Okay, great so think of what type of equations we've studied, what that form is, and what the different information we have represents in that equation"*

Once the students have come up with their equations, direct them back to their tasks and ask how they can determine the day the two students play intersect and at what level. Also ask them what they will do for their graphical representation of their combined model. Monitor their progress and help lead them to graphing the lines.

If someone interprets visual representation differently steer them accordingly such as:

Teacher: *"What did yall decide to do for the visual representation"*
Student: *"Well, one of us is going to bring in a game and show the class one of us playing faster"*
Teacher: *"That certainly is a visual representation, but the goal here is to present your results to the class so a different type of "visual representation" is desired here. Think about what might be a helpful visual for someone to see both of your progression and the point of intersection".*

Now that everyone has completed their model, take 5 minutes and present your findings with another group.

Once presentations are done ask the class to take 5 minutes to brainstorm and write down potential problems with their model and what would change if key assumptions were changed.

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Task
Using the video game information given, determine how many days it will take the player starting a week later to catch up to the level their friend. Use a model to determine a graphical representation.

(1) **Videogame chosen:**

(2) **How much time can you play per day?**

(3) **List of assumptions made:**
  (a) The first player spends fewer hours per day playing.

  (b)

  (c)

  (d)

  (e)

(4) **How many levels can you increase per day?**

(5) **What level is the first person at when the second person gets the game?**

(6) **Equations for your Model:**

(7) **What day does it take for the second player to catch up to the first player?**

(8) **What level are the players at when they are equal?**

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(9) **Graphical Interpretation**

(10) **Discuss potential flaws in your model and give 2 examples of how your model would change if you changed assumptions**

Check this link out for further interest, in particular the calculation link:
http://heavy.com/games/2016/08/pokemon-go-xp-calculator-level-30-40-how-long-will-it-take-to-reach-up-amount-of-number/

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Video Game Completion Rates for an Average Player

Video Game	Total Number of Levels	Number of Hours To Complete
Halo	50	300 hours
Skyrim	40	120 hours
Fallout	40	200 hours
Pokemon Go	40	2100 hours
Candy Crush	2065	1500 hours

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Sample Solution

(1) **Videogame chosen:** Halo

(2) **How much time can you play per day?** 5 hours, 3 hours

(3) **List of assumptions made:**
   (a) The first player spends fewer hours per day playing.

   (b) Both players are of the same skill level.

   (c) We play the same out each day-linear model

   (d) The video game has a maximum number of levels, but we will intersect before that point.

   (e) Leveling is continuous

(4) **How many levels can you increase per day?** $\frac{5}{6}$, $\frac{3}{6}$

(5) **What level is the first person at when the second person gets the game?** $\frac{7}{2}$(3.5 as a decimal)

(6) **Equation for your Model:**
   $y = \frac{5}{6}x$
   $y = \frac{1}{2}x + \frac{7}{2}$

(7) **What day does it take for the second player to catch up to the first player?** $\frac{21}{2}$(10.5 as a decimal)

(8) **What level are the players at when they are equal?** $\frac{105}{12}$(8.75 as a decimal)

(9) **Graphical Interpretation**

(10) **Discuss potential flaws in your model and give 2 examples of how your model would change if you changed assumptions**
Leveling up is not a continuous process, so although this assumption had to be made for us to use linear equations to model the circumstance it is not realistic. If the levels gained per day rates were the same then the two players would never be at the same level at the same time. There is also the potential for the lines to intersect after a maximum level for the game which would be meaningless since the players would finish the game without every being on the same level.