TeachEngineering

“TUNING” SIMULATION GAME: MODELING ITERATIVE REFINEMENT

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“Tuning” Simulation Game: Modeling Iterative Refinement

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GOAL:

The goal of the game is to illustrate the process of iterative refinement in finding a numerical value through repeated guesses and adjustments based on feedback.

MATERIALS NEEDED:

- Writing utensils
- Paper or whiteboard to write on
- Calculator (optional)

TEAM ROLES:

- “Keeper” (K) - this is the person who will choose the *secret* numerical value
  - 1 piece of paper
  - 1 writing utensil
- “Guessers” (G1, G2, G3) - these are the 2 or 3 other people who will guess values that they add to check against the secret value. Each needs:
  - 1 piece of paper
  - 1 writing utensil
  - G1 may use a calculator

STEP 1: Choose the Secret Number

- The Keeper (K) chooses a number between 1 and 100.
- K writes down the number but does not reveal it to others.

STEP 2: Make Initial Individual Guess

- Guessers (G) each independently choose a number between 1 and 100.
- Gs write down the numbers they chose but do not reveal the number.

STEP 3: Calculate Team Guess

- K says “Guess.”
- Gs reveal their numbers.
- G1 adds all the numbers together and presents the final result.
    - For example: If G1 = 25, G2 = 30, G3 = 40, then the total sum is 95.

STEP 4: Knower Responds

- K gives feedback to Gs, without revealing the secret number.
  - If the sum is higher than the secret number, K says “Too high”... Go on to Step 5.
  - If the sum is lower than the secret number, K says “Too low”... Go on to Step 5
  - If the sum is correct, K says “Correct!” ... Game ends!

STEP 5: Refine Individual Guesses

- Gs discuss ideas about their next guess **but do not reveal or suggest specific numbers.**
- Each G writes down their own number.

STEP 6: Calculate New Team Guess

- K says “Guess.”
- Gs reveal their numbers.
- G1 adds all the numbers together and presents the final result.
  - For example: If G1 = 25, G2 = 30, G3 = 40, then the total sum is 95.

Example Game Sequence

- K's secret number is 50 (written down secretly).
- Guessers choose their numbers:
  - G1 = 30, G2 = 40, G3 = 50
  - Total sum = 30 + 40 + 50 = 120
- K says: "Higher" (because 120 > 50).
- Guessers discuss and refine their numbers.
- Maybe G1 and G2 decide to try lower numbers, while G3 sticks with 50 (secretly, not shared).
- The Guessers adjust their numbers and try again:
  - G1 = 20, G2 = 25, G3 = 30
  - Total sum = 20 + 25 + 30 = 75
- K says: "Lower" (because 75 > 50).
- The Guessers adjust again:
  - G1 = 15, G2 = 25, G3 = 35
  - Total sum = 15 + 25 + 35 = 75
- K says: "Lower" (because 75 > 50).
- The Guessers adjust again:
  - G1 = 15, G2 = 20, G3 = 20
  - Total sum = 15 + 20 + 20 = 55
- K says: "Lower" (because 55 > 50).
- The Guessers adjust again:
  - G1 = 10, G2 = 15, G3 = 20
  - Total sum = 10 + 15 + 20 = 45
- K says: "Correct!" (because 45 matches the original number).

Discussion Questions:

- How could you have made this process more efficient?
- How was this game similar to the way in which a scientist might try different combinations of materials to identify the best one?
- Why might a materials scientist use a computer simulation like this instead of building and testing combinations of materials using real physical objects?
- (For students with computer science background) What code segments or functions did this game remind you of?

Key Takeaways:

- **Iterative Refinement**: This game highlights how refining your approach (in this case, guesses) based on feedback leads you closer to a solution.

- **Feedback Loops**: The feedback from the Keeper guides the Guessers to adjust their numbers systematically.