Lost at the Forever Mine

Lost at the Forever Mine, a product of the University of Wisconsin Materials Research Science and Engineering Center's Education Team and the Field Day Lab, is an introduction to the mathematical modeling that scientists and engineers practice to describe data and predict future outcomes.

In this game, the player crash-lands on a planet with an abandoned mining facility, the Forever Mine. With only seven days of oxygen remaining after the crash, the player utilizes the robots on the planet to try harvesting enough fuel to leave the planet and return home. Players work with an artificial intelligence to use limited mining data available to create mathematical models that describe the mining system. Players then employ their models to predict whether they will extract enough fuel before they run out of oxygen. On each day of their adventure, players contextualize the components of linear equations, using a data table to inform the initial fuel values (y-intercept) and mining rates (independent variable coefficients) in their model and visualizing these changes on a graph in real-time. As the game advances, players model more complex systems to optimize the mining process and escape the Forever Mine!

Save Codes

When the game first loads, players are able to start a new game, continue where they left off (stored in the browser), or enter a "save code" to jump directly to any state in the game. Below is a complete list of the codes:

Level 1	*stranded*
Level 2	*goodnews*
Level 3	*badnews*
Level 4	*icanfixit*
Level 5	*status*
Level 6	*leftovers*
Level 7	*willitwork*

Level 8	*solar*
Level 9	*goodenough*
Level 10	*dontgo*

Standards

Developing and using models is one of the eight cross-cutting science and engineering practices in the NGSS Framework. From the NGSS Framework: "Developing and Using Models - a practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations." This game is designed as an introduction to mathematical models and their utility in describing and predicting phenomena.

MS-ETS1-4.
Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
This standard is met in the game by having the player iteratively improve the mining process such that an optimal design can be achieved and the player survives.

What is a Model?

A model is a tool that scientists and engineers use to understand ideas or explanations that arise from experiments, observations, and data. Models take many forms – they can be drawings (e.g. a drawing of a cell), diagrams (e.g. a labeled drawing of the layers of the earth), mathematical equations (e.g. the equation for a line), graphs (e.g. a pie chart of the ages of students in the classroom), physical replicas (e.g. a solar system made of foam balls), or digital representations (e.g. a video of DNA replication). Models are useful tools to explain complex ideas, but they all have flaws and limitations. For example, a drawing of a cell shows what the different components are and where they are located, but it does not accurately represent the actual size or function of the components. When using a model, it is important to understand the flaws and limitations so that you fully understand what the model is trying to represent while avoiding misconceptions.

What is the Practice of Modeling?

In addition to using models, scientists and engineers create models to explain ideas or theories that arise from experiments, observations, and data. The practice of modeling is when a person represents their own way of thinking about a concept in a physical representation. Recreating a model that represents another person's thinking (e.g. copying a picture of a cell from a book) is not the practice of modeling, although it is a way to use a model. If students collect data and then create a model (e.g. a graph or drawing) to explain that data, that is the practice of modeling.

What is Materials Science and Engineering?

The player in the game is a Materials Scientist. Materials scientists and engineers create and analyze the stuff that goes into everything made by people – computers, cell phones, shoes, roads, buildings, windows, really anything that people make, include materials made by materials scientists. Materials Science and Engineering is a field that includes a wide variety of disciplines, including engineering, chemistry, physics, math, and computer science, among others. The materials scientists who developed this game make new materials on very small length scales (i.e. the nanometer scale) and then study these materials to see what properties they have, including strength, flexibility, electrical conductivity, and stability. The materials that have desirable properties can be used to make new devices – like semiconductors in computer chips that can hold more information in less space with less energy.

Materials scientists create models to predict whether and in what ratio different atoms will combine to form new materials, as well as what properties the new materials will have. Because there are so many combinations of atoms, models enable materials scientists to analyze hundreds of thousands of combinations rapidly on a computer to decide which combinations are worth pursuing in the lab.

This process saves an incredible amount of time and money while making the discovery of new and useful materials much faster.

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