Este recurso es fruto de la colaboración entre la Fundación Germán Sánchez Ruipérez e Intel Corporation y han sido cofinanciados por el Fondo Europeo de Desarrollo Regional en el marco de la Iniciativa Comunitaria Interreg IIIA, España-Portugal.

AIMS AND OBJECTIVES

Why a simulation?

The theory behind a simulation is to create an environment where a user can immerse himself in an environment, experiment and take risks at their own pace where mistakes can be made without any consequence to the user. The simulations are goal based and can be used also as open ended and purely experimental. With the physics tools we have endeavoured to create differing simulations each with a differing approach, but all with a strong curriculum based target in mind.

The main emphasis of each simulation is to make the user aware that each of their actions has a bearing on the experiment.

Each of the experiments is set up to let teachers pre-prepare lesson plans around them, for students to address a goal or choose to investigate more openly and they can be used in a classroom or home environment.

Density Investigation Tool

"This tool enables students and teachers explore mass and volume for a variety of solids and liquids and hence determine their densities. The investigation is set in a crime lab where finding the densities of the various items can solve the crime."

This simulation begins with the typical experimental based approach:

- Planning - A guide to the best investigative path
- Experimentation - A simulated experiment
- Analysis - Reflection on the outcomes
- Graphing - Charting the results
- Evaluation - Reviewing the results in light of the variables selected.

In this simulation the above approach is very important to the structure of the simulation. It is an opportunity for teachers to reinforce scientific thinking in the students through a systematic and thorough approach to an experiment. Each of the approach pages presents to the user a series of options that would be available to the students setting up a density experiment. They were carefully chosen to stimulate thought and prompt the users to think though what they are doing before the experiment starts.

The simulation presented to the user in this instance covers 2 approaches.

The user can approach the experiment from a goal based scenario at the start. The answer to the question posed ensures the user understands density; it uses physical investigative techniques using a graduated cylinder, a scales and some theory techniques to calculate the density of each object by using the mass and volume previously found. The CSI approach was taken to capture the imagination of the target users and get them to imagine themselves performing a critical role in a criminal investigation.

The user can also use the experiment environment to investigate density in an open ended learning experience. If they choose to ignore the challenge they can investigate mass and volume at their own pace.

The selections of items used in the experiment were carefully chosen to let the user establish sound results for each material type and base a decision on this. There is a variation in material and size to reinforce the fact that size does not affect the mass, but the density.

Lenses Simulation

"This simulation illustrates an application of light refraction using lenses. The challenge is to complete a series of tasks based on light refraction using both concave and convex lenses."

This simulation has a more closed approach than the density one. The challenge is clear and simple. At present a lot of text books present light refraction in black and white images and this is something that was identified as an issue in progressing learning. The use of coloured lines to illustrate refraction was aimed at challenging this.

The other main learning from this simulation is that the experiment has to be performed by actually putting the lenses in place rather than an assessment of the shapes of the lenses beforehand.

The other main point of this simulation was the introduction of an unlimited number of attempts but a defined goal. This introduces a level of competitiveness between students to see who can get the best result. As results get better the user improves their understanding of refraction.

Electromagnet Simulation

"This simulation explains how an electromagnet works. It illustrates the connection between the power applied, the number of coils and magnetism. The challenge is to change the magnetism of a scrap lifter in a scrap yard to remove various amounts of scrap."

This simulation takes a real world application of a scientific theory. This is tool is aimed at increasing awareness of real work applications for school based science theory and experiment.

The simulation itself is another goal specific model of learning. The task introduces several variables that have to be considered to accomplish the task. Simply increasing the power or the number of coils alone will not achieve the goal of the task.

Expansion and Contraction Simulation

"This simulation illustrates the expansion of solids, liquids and gases when heated and contraction when cooled. The challenge is to control virtual bridges using expansion and contraction so that a car can pass over them."

This simulation takes a very different approach to the simulations above. The challenge takes the user away from a real world application of the science to illustrate the points required. This was done to remove the most important restriction, scale from the learning. Expansion and contraction had to be illustrated in a clear and visible way to the user and that is why the three scenarios were developed. The challenge in running the car across the various apparatus is about awareness that the application and removal of heat affects expansion and contraction. The apparatus were based on the 3 main curriculum applications of this for solids, liquids and gasses.