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Introduction to Technology in Schools
Fall 2008

Technology Integration Learning Plan (TILP)

Overview

Subject: High School Physics (10th, 11th, and 12th grade)
Lesson: Introduction to Trajectories, Projectiles, and Range
Technology: A computer game ("Schorched3D") and Word Processing / Spreadsheet Application

Analysis

High School Physics students need to understand how projectiles work. Students will enter this lesson with an understanding of concepts such as acceleration, velocity, vector vs. scalar values, Newton's laws of motion, and the Kinematic Equations. Students will use this knowledge to construct a basic understanding of projectiles and trajectories in this lesson.

Generally, the purpose of science education is to teach critical thinking and how the scientific method can be used. Students playing the game will employ the scientific method (hypothesis, experiment, analysis) in order to construct new knowledge.

Time Requirements

This activity requires in class time and out of class work in the form of a write up. In class time consists of a 30 minute session, including a five minute demonstration of how the game is played, and a ten minute explanation of how they need to record and explain their work.

Design & Development

Objectives
- Students will gain a basic understanding of Trajectories, Projectiles, and Range
- Students will use the scientific method and existing knowledge to construct new knowledge
- Students will communicate their findings in the form of a write-up and spreadsheet representation of their data.

Resources
- Schorched3D – an open source artillery game that runs on Mac OS X, Linux, and Windows operating systems. This will require a computer lab. This software uses a physics engine that simulates real world physics.
- Word Processing and Spreadsheet software
- Website - http://hyperphysics.phy-astr.gsu.edu/Hbase/traj.html if the students want to learn more.

Structure & Sequencing
- In class session:
  - Demonstration of how the game works (5-10 minutes)
  - Explanation of how they should record their data (5 minutes)
    - The Student should record their velocity and vector for each "shot" as well as the result of that shot.

- o Questions that they need to keep in mind as they play (5 minutes)
  - How does changing the exit velocity and angle affect the flight of the projectile?
  - What angle would give you the best range?
  - Can you hit the same point using different angles and velocities?
  - o Game Play (20 minutes)
  - o Help with using the office applications (if necessary)
- Out of class
  - o Inputting the data into the Spreadsheet program
  - o Completing a write-up of their analysis and discoveries where they answer the questions posed to them at the beginning of the lesson (see above).

Assessment

The assignment is assessed according to the following rubric:

Using Schorched3D to learn about Projectiles, Trajectory, and Range – Rubric

	Incomplete 0 Points	Beginning 1-5 points	Developing 6-10 points	Exemplary 10-15 points	Score
Data Record	Student did not record any data	Data was recorded sporadically (less than 5 records)	Data was recorded acceptably (6-14 records)	Data was recorded exceptionally (15+ records)	
Analysis	Student did not provide any analysis	Analysis did not reflect the recorded data	Analysis describes the data instead of drawing any conclusions	Analysis reflects the recorded data and contains conclusions that can be drawn from that data.	

Using the Schorched3D software has several advantages over using actual projectiles (e.g. a potato gun). The biggest advantage is that there is no physical danger in using the game. Using a simulation will give opportunities for better control over their shots as well. There is also a financial advantage in that the software is free both financially and philosophically (open source).

The theoretical learning perspective this lesson uses is Constructivism. Students are taking knowledge they already have, experimenting and using it (in the software) to gain new experience and then analyzing that experience to create new knowledge. By thinking about the subject matter without direct input from the teacher, a deeper (but more generalized) understanding of the subject matter can be obtained. The actual mathematics of the subject will be taught separately.

Implementation

- The Schorched3D software will need to be loaded on the computer ahead of time.
  - o As the software runs on all platforms, there shouldn't be an issue with getting the software loaded.

- o The software does use 3D graphics, and may run acceptably slow on older computers.
  - o There may be difficulty installing and configuring on Linux machines.
  - o If a student misses the class, they could possibly install the software on their home computer to complete the assignment.
- The computer lab will need to be reserved ahead of time. There may be some flexibility in which day the lesson is giving to match availability of the computer lab.
- If a student does not have access to a computer at home, either more lab time can be scheduled or the final paper can be created using paper and pencil.

Evaluation

Students will have successfully completed the assignment if they gain a general understanding of how projectiles work. If they record their actions during the games rigorously and then analyze how their actions / hypothesis affected the outcome, then they have a representation of how projectiles work. Finally, the teacher discovers how successful this lesson was through the written report by the student explaining and analyzing their findings.

Using Technology in this assignment enables for greater experimentation and greater flexibility with what the students are able to see and do. Using projectiles in the real world carries several safety risks, and by using technology, those risks are minimized.

The outcome of this assignment can be used as a starting point for explaining the equations of projectiles and how the different mathematical operations reflect their data from the game.

Missouri Grade Level Expectation:
Strand 2: Properties and Principles of Force and Motion
Concept E: Perpendicular forces act independently of each other
Scope and Sequence: Describe the forces acting on a projectile on the Earth
ISTE NET Standard:
1) Creativity and Innovation - use models and simulations to explore complex systems and issues